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THE AMERICAN GAS LIGHT JOURNAL

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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

Thirty-Second Annual Meeting, New England Association of Gas Engineers.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.
OFFICE OF THE SECRETARY,
NEW BEDFORD, MASS., Dec. 26th, 1901.

The Thirty-Second Annual Meeting of the New England Association of Gas Engineers will be held in Boston, February 19 and 20, 1902. The headquarters will be in Youngs' Hotel as usual; but, owing to the increased attendance at the meetings, which necessitates the securing of a larger assembly room, the sessions will be held in the Parker House.

A lively interest in the meeting is being shown by members, and the programme in detail will be issued later. W. W. GIFFORD, Sec'y.

[OFFICIAL NOTICE.]

First Annual Meeting, Wisconsin Gas Association.

RACINE, WIS., Jan. 15th, 1902.

The First Annual Meeting of the Wisconsin Gas Association will be held in Madison, Wis., on Wednesday and Thursday, the 12th and 13th days of February. The headquarters of the Association will be at "The Park," where accommodations can be had at the rate of $3 per day, and rooms with baths for $4 per day.

Unless advised to the contrary the Association meetings will be held in "The Park." HENRY H. HYDE, Secretary,
Wisconsin Gas Association.

[OFFICIAL NOTICE.]

Ninth Annual Meeting, Michigan Gas Association.

MICHIGAN GAS ASSOCIATION,
OFFICE OF THE SECRETARY,
ANN ARBOR, MICH., Jan. 23, 1902.

To the Members of the Michigan Gas Association: The Ninth Annual Meeting of the Michigan Gas Association will be held in Kalamazoo, Mich., on Wednesday and Thursday, February 19 and 20. The headquarters of the Association will be in the Burdick House, where a rate of $2.50 per day has been made. As hotel facilities are somewhat limited better accommodations can be secured by writing in advance. A good programme will be presented, part of which will be a lecture, by Mr. E. D. Campbell, Professor of Analytical Chemistry, University of Michigan, on "The Function of Original Research in a Technical Education." HENRY W. DOUGLAS, Sec'y.

[OFFICIAL NOTICE.]

Ohio Gas Light Association—Novelty Advertising Department.

OHIO GAS LIGHT ASSOCIATION,
OFFICE OF THE SECRETARY,
DELAWARE, O., Dec. 24, 1901.

Members of the Ohio Gas Light Association are earnestly requested to send to Mr. B. W. Perkins, South Bend, Ind., any contribution they may have for the Novelty Advertising Department of the Association. This is a most favorable time, just at the close of the season, when the many successful methods of advertising tried during the year are still fresh in the minds of those who used them. T. C. JONES, Sec'y.

BRIEFLY TOLD.

THE ANNUAL MEETING OF THE CONSOLIDATED GAS COMPANY.—Last week the annual meeting of the Consolidated Gas Company, of New York, was held, as usual, in the main offices of the Company, No. 4 Irving Place. The meeting seems to have been harmonious, since no change is reported in the make-up of the Board of Directors from the representation of last year. The personnel of the Board is as follows: Samuel Sloan, H. E. Gawtry, J. P. Huggins, Wm. Rockefeller, Geo. F. Baker, M. T. Pyne, Jas. Stillman, S. S. Palmer, F. A. Schemerhorn, Frank Tilford, Wm. C. Whitney, A. N. Brady and Thos. F. Ryan—in this enumeration it will likely be noted that the "bad boys" of the trying times of '98 and '99 are placed at the "foot of the class." Some statistics representing the standing of the Company were vouchsafed the shareholders. It was admitted that the Company sold 16 thousand millions cubic feet of gas during the year, and that its furnishing of "kilowatts" on electrical account for the twelvemonth showed an increase of 19 per cent. in comparison with the output for 1900. It was conceded that the maximum output of gas for any 24 hours was 70,000,000 cubic feet; and it was declared that expenditures on construction charges were thus divided: On gas works' account, $1,700,000; on electric light works' account, $2,300,000; on repairs—presumably to both ends of the supply—$895,000. Depreciation figures are returned at $700,000. So far as the public may judge from the returns offered, it must be conceded that Mr. Sloan and his confreres in the Consolidated Gas Company have had a "good year" therein; otherwise the figures show nothing to a gas man save that the electric end of the Company's trading is being well fostered at the expense of the gas end.

A GOLDEN TIME.—It may be a little out of tune to connect the jargon of the last formal meeting of the shareholders of the Consolidated Gas Company with the harmonious strains that sound in the celebration of a golden wedding ceremony, but nevertheless such commingling is here reported. Perhaps no other man "in these parts" is better acquainted with or has more intimate knowledge of the development of the gas business in New York and Brooklyn than has Mr. James D. Perkins, the senior member of "The Perkins Company," who as traders in their particular line are known the world over. But it is not of his trading that we would here write, since our present desire is to note that never a prettier golden wedding reception was held than that which marked the ceremonies on the occasion of the 50th anniversary of the union of himself and his cherished, devoted wife. The renewal of the tryst of half a century ago was held in their handsome home, 123 Woodland avenue, Residence Park, New Rochelle, N. Y., the evening of the 14th ult., and that it was as true in the ring as was the happy song of "auld lang syne" is best proved by the presence in New Rochelle at the time named of many old and young who traced themselves to either of the happy pair through respect born of long association or of the affection that is inseperable from close lineage.

THE MEETING OF THE WISCONSIN GAS ASSOCIATION.—While our official notice respecting the first annual meeting of the Wisconsin Gas Association, which is to be held in Madison, Wis., the 12th and 13th days of this month, suggests that the assembly room is to be in "The Park"—which is named as the headquarters, and which is in reality the name of a hotel—unofficial advices are to the effect that the sessions will be in the Senate Chamber of the State House. Among the papers listed are the following:

"A Year's Experience in Distributing Gas Under High Pressure;" by Mr. Geo. F. Goodnow, Waukegan, Ills.

"Bench Firing with Coal;" by Mr. R. C. Cornish, Racine, Wis.

"The New Business Problem;" by Mr. Ewald Haase, Milwaukee, Wis.

"A Year's Experience with Vitrified Pipes for Gas Mains in Madison;" by Mr. M. E. Malone, Madison, Wis.

"Gas Engines in the Electrical Department of a Gas Company;" by Mr. George Warnking, Oshkosh, Wis.

A very well arranged entertainment plan has been adjusted, and the Association extends a hearty invitation to be present at its doings to every gas man who can manage to be in Madison on the appointed day.

NOTES.—The City Council, of Cadillac, Mich., has granted a franchise for the operation of a gas works in that city to Messrs. C. H. Cady, F. W. Green, R. W. Massey, W. J. Cornwell and E. F. Sawyer. The life of the grant is 30 years. It is said that the plant will be constructed this summer.——A movement for the establishment of a gas plant "in Baldwins, L. I., and places adjacent thereto" has been started by Mr. Andrew Imming, of Baldwins.

The Use of Lime in the Distillation of Ammoniacal Liquor.

In a recent issue of the *Journal of Gas Lighting* was printed the following abstract translation of a paper, on the topic named in the heading, read by Mr. E. Blum, of Berlin, Germany, before the Giessen sessions of the last meeting of the Mid-Rhenish Association of Gas and Water Engineers:

Ammonia is a bye-product of gas manufacture of much importance, as it forms a considerable source of revenue to the works. It is clearly economically important that the washers should be capable of abstracting the ammonia as completely as possible from the gas, that loss of ammonia should be avoided from liquor tanks and by volatilization from uncovered overflows, etc.; and, finally, that the spent liquor from the sulphate plant should be thoroughly exhausted.

The importance of care in the working up of the liquor to sulphate may be readily shown by an example. A gas works making about 350,000,000 cubic feet per annum would, if the effluent or spent liquor of the sulphate works contained only 5 parts of ammonia per 100,000, sustain an annual loss of about 364 pounds of ammonia—value (say) about $26.75. But if the spent liquor contained 5 parts of ammonia per 10,000—by no means an exceptional quantity when old apparatus is used—the annual loss would be 10 times as great, or in value about $265.

Given good distilling plant, the more nearly the lime is added in the proper ratio to the amount of ammonia there is to be extracted from the liqnor, the better will be the result obtained. In most cases the milk of lime is introduced into the apparatus through a hand pump, with which a given number of strokes are made at prescribed intervals, fixed according to the amount of liquor being dealt with at the time. At coke oven works there are special clocks which give a signal when the time arrives for pumping; but, even with these, the addition of lime remains dependent on the care and conscientiousness of the workmen. In order to make it independent of the workmen, Debruck, of Düsseldorf, has adopted a means of operating the pump automatically by the agency of the water flowing away from the condensers. The water flows into a tumbling bucket, which is connected with the pump in such a manner that a stroke is made each time the bucket tips. The interval between the strokes can be altered by regulating the flow of water to the bucket. As water under pressure is not, however, always available, and is often costly, and as steam is in any case required for the liquor plant, an attempt was made to effect the addition of the milk of lime by means of a direct action steam pump. Such a pump, with cataract valve gearing, was tried first at Messrs. Otto's works at Dahlhausen, and proved so satisfactory that, with the addition of a distributing valve, devised by the firm for the supply of a number of stills, it was afterwards supplied to many other gas works, including Chemnitz, Bromberg, Leipsic, Posen, Stockholm, Berlin (the Imperial Continental Gas Association's and the Lichtenberg), etc., and many other ammonia works.

This pump is shown in Figs. 1 to 5. In these K is the milk of lime tank; R, the stirring gear operated by the pump; and V, the distributing valve. The characteristic part of the steam pump is the cataract gear. In the casing A is a rubber membrane B, which in the figure is shown close to the top of the casing. This membrane is lowered by the weight C when the tap D is open; and its descent occurs more slowly the less fully the tap is open. As the membrane falls, the rod E attached to it strikes the lever F, and depresses it. By this means, the regulating arm G, which was held by the lever H actuated by F, is liberated; so that the extended spring I can act on it, and thereby open the steam admission port to the cylinder. The plunger is thus raised, and so moves G through the levers F and H and the spring I, that the steam admission is cut off at the right moment. At the end of the stroke, the peg K raises the lever F, whereby the regulating arm G held by H, is again liberated, so that it can force upwards the extended spring. By the ascent of the plunger, the membrane of the cataract is again raised, and air is drawn into the casing A through the valve L. With the descent of the membrane, the operations described commence again. The number of strokes made can be regulated within wide limits by altering the position of the tap D.

The distributing valve, shown in Fig. 5, contains as many chambers—each supplied with a ball valve—as there are different sets of apparatus to be supplied; one chamber being appropriated to each set. The balls of the valves are kept down by the weight, except the one in the chamber which is connected with the set to be supplied with milk of lime. The balls in the different chambers are set free by the transmission of the movement of the plunger to a toothed wheel having teeth corresponding

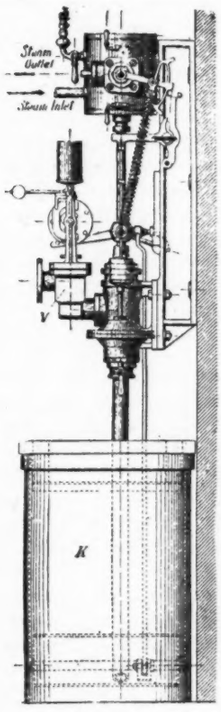


Fig.1

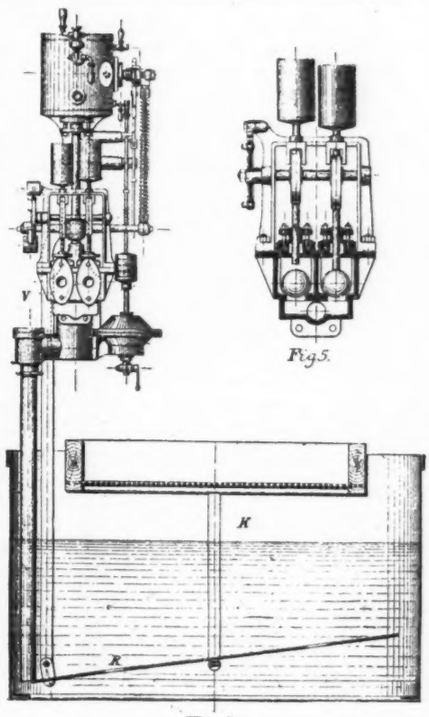


Fig.2.

Fig.5.

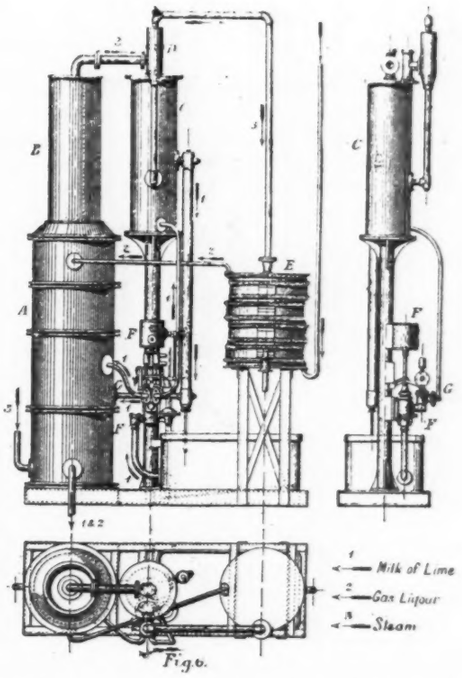


Fig.6.

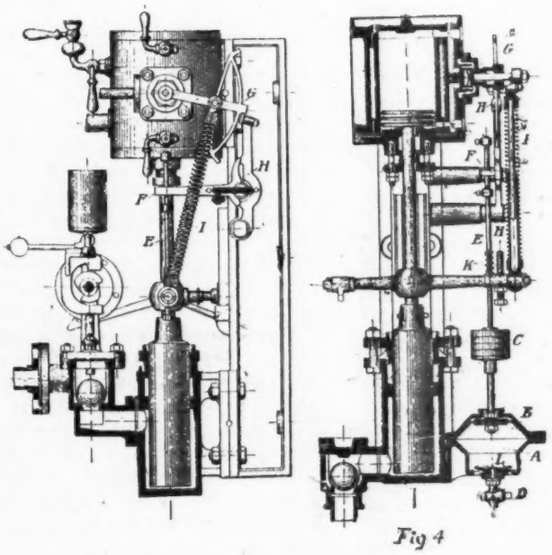


Fig 4

to the number of chambers. The illustration sufficiently explains the way in which the appliance works.

The distributing valve becomes of special utility in cases where concentrated gas liquor is produced. The concentrated liquor, as is well known, is made by condensing the vapors of ammonia as expelled from the still, in a cooler. As a rule, the product is not made with more than 15 per cent. of ammonia in it. But a patent carbonic acid washer, inserted between the still and the condenser, admits of concentrated liquor of much higher strength being obtained. At the Schlieren works, at Zurich, an average of 23.5 per cent. of ammonia in the concentrated liquor was thus obtained over a year; and at Lichtenberg, near Berlin, 25 per cent. Evidently this strong liquor can return a higher price to the works whenever it has to be forwarded to a distance than the weaker product, as carriage has to be paid on so much more water in the case of the latter.

The mode of working with the carbonic acid washer, which is at a high level, is to introduce into it milk of lime, which removes the carbonic acid from the vapors issuing from the distilling apparatus. The lime becomes completely saturated, and the quantity used corresponds with the amount of carbonic acid removed from the gas. Thus liquor containing more or less carbonic acid may be made at will. The water, mixed with carbonate of lime, flows from the washer into the distilling plant, and milk of lime is added in the requisite amount for liberating the fixed ammonia. By the use of the distributing valve the alternating supply of lime to the carbonic acid washer and to the distilling plant can be effected automatically in the proper proportions, corresponding to the composition of the liquor which is being worked up. It is easy, by dividing the toothed wheel accordingly, to supply the milk of lime to the washer and the distilling plant in the relative proportions of 3:2 or 4:3 or 5:3, etc., as desired. The pump in the last example (for instance) feeds the washer during 5 strokes, and the distilling plant during the next 3 strokes.

The method of arranging the pump in conjunction with a small concentrating plant, which works up 660 gallons of liquor per 24 hours, is shown in Fig. 6, in which *A* is the distilling apparatus; *B*, the reflux condenser; *C*, the carbonic acid washer; *D*, the lime catcher, which serves to stop any lime carried up; *E*, the condenser in which the vapors are condensed; *F*, the steam pump; and *G*, the distributing valve. The whole plant is constructed so that only a short time is required to erect it in position. It is necessary that regularity and uniformity should be observed in the flow of liquor, the pressure of steam and the addition of lime.

The inflow of liquor is regulated by sending it through an apparatus with a float for maintaining a constant head; while the quantity is exactly measured by means of a tipping vessel with a clockwork recorder.

The pressure of steam is regulated, and kept constant, by means of a pressure-reducing valve. The milk of lime is always mixed to the same strength (10° Beaumé) before it is pumped. A counter attached to the pump enables the number of strokes made to be seen at any time. The inflow of liquor and the number of strokes of the pump must be kept in a certain proportion, which must be fixed from tests made before starting work.

The steam pump makes, say, two or three strokes per minute at definite intervals—thus stirring up the milk of lime, and preventing deposition of carbonate in the pipes. When it was not employed, the workman had to make 30 to 45 strokes with the hand pump every quarter of an hour—thus introducing at once the whole of the milk of lime required for that period. The attention needed to be given to the plant has been so much reduced by the introduction of the steam pump, etc., that one man can look after it and do other work also. Thus the wages become much diminished, and many small works which have hitherto found it difficult to obtain any return from gas liquor, can secure considerable sums by working it up. When the liquor is worked up on the spot, it is not so important to make it of high strength as when it has to be sent to a distance.

The method of preparing concentrated ammoniacal liquor and the apparatus therefor, described above, afford to works of medium and small size the power of securing more favorable returns from their gas liquor.

New Expansion Bolt for Electrical Work.

The accompanying illustration shows a new hollow expansion bolt manufactured by the Steward & Romaine Manufacturing Company, of Philadelphia, Pa. This particular bolt is intended for fastening arc

lights and electrical fixtures to walls, arches, bends and the like. Being hollow, the electric wires are run through the center of the bolt into or through the walls, as shown in the illustration.

Reinforced Concrete Construction.

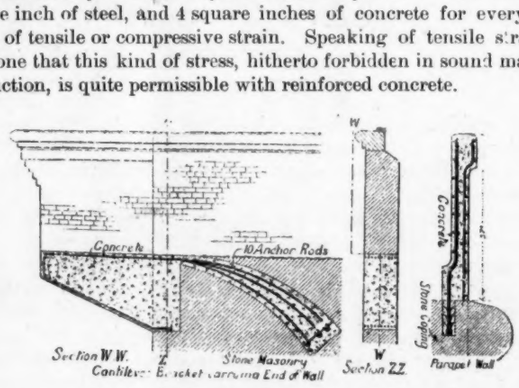
The *Journal of Gas Lighting* says that the development of engineering practice on the side of labor saving appliances is one of the most interesting of studies. Mechanical engineering was the first in this field with labor saving machines—indeed, in a sense all power machinery is of this category. One cannot mention the horse power of an engine without implying the consideration that it substitutes, and consequently saves, the equivalent amount of animal labor. It is of the recognition of labor saving as a point in civil or constructional engineering, however, that we propose to treat in the present article. For it is becoming better recognized every day that, in the design of engineering structures, the question of how they are to be constructed, with special reference to labor conditions, possesses capital importance. This consideration did not enter into the calculations of civil engineers, until quite recent times. Where it was a question, for example, of making a gasholder tank, the choice was understood to be determined in favor of one material of construction rather than another by certain considerations of fact and of locality. The idea of regarding the workman as an element in the matter never occurred to the designer. If the selection fell upon a brick tank, for general reasons, the thought that the bricklayers might introduce a disturbing factor into the estimates was never entertained. Where there was brickwork to be done, it was assumed that bricklayers would be forthcoming to do it; and there an end.

Modern labor developments have changed all that. The unnamed principle underlying the Trade Unions which control handicrafts, is that the work in question is a monopoly of those specialists who are called after it. Consequently, these handicrafts are organized, and the conditions of working are settled exclusively in the interest of the monopolists. All the controversy that has been going on of late in the *Times* and in other newspapers on the subject of the "Crisis in British Industry," refers really to the alleged overruling of all handicrafts in the sole interest of the workman, regardless of everything and everybody else. It is further asserted that the net effect of this "organization of labor," in the Trade Union meaning of the term, is to raise the cost of the work done, by reducing the amount rendered by the men in return for their wages; and also by the irritating and expensive working rules which are insisted upon where a Trade Union is in a position of influence. Brickwork is named as an example in point, it being alleged that there is a conspiracy among Society bricklayers to lay no more than two bricks in the time which formerly sufficed for the laying of three; while there are hard and fast lines separating the proper work of the bricklayer from that of the plasterer and the pavior —not to mention other artificial restrictions on the work of brickwork construction. It is clear, that whatever the degree of truth there may be in this impeachment of bricklayers, it constitutes a matter for constructors to take into their calculations in deciding upon the material in which designs shall be carried out. The setting up of a monopoly on the one hand can usually be countered on the other by dispensing with the subject of it in favor of some equivalent.

This is the origin of labor saving in construction, as an engineering exercise distinct from the use in production of labor saving machines. It is part of this movement that has induced engineers to give a revived attention to the construction of works in masonry, instead of in metal. A few years ago, many structures in and about works—such as viaducts, roofs and sheds—would have been designed in metal as a matter of course. But there has been a marked change of practice in this regard. For all structures expected to last, masonry—using the word in its widest significance—is being preferred to metal, by reason of the endless cost of preserving and painting the latter. The science of engineering did not for a long time take the painter seriously. The item of painting gasholders and their framing, and roofs exposed to steam and corrosive gases, was treated as a small incidental. Experience has taught engineers to look upon the scraping and painting of structural ironwork as a very grave matter indeed. Economize painters' labor as we may, by the aid of sandblast cleaning and machine painting, it amounts to a heavy tax upon the value of the structures wherever it is properly attended to; and in places where it is not done, the broken down aspect of things is depressing in the extreme.

It is becoming a point of sound engineering never to employ exposed metal where masonry can be used as well, with the expenditure of a little ingenuity. In a few years the appearance of many British engineering works will be considerably altered in this way. Of course, when we say masonry, we mean also concrete, including the armored or reinforced variety of this material. The engineer cannot afford to fall into the hands of the stonemason or the bricklayer; and as a matter of fact, he is daily getting to be more independent of these highly skilled, and still more highly organized, handicraftsmen. In the United States, as well as in France, where members of the building trades are especially to be avoided whenever possible, reinforced concrete is admitted to be the chief modern building material. Recently, the *Engineering Record* published a description, with plans, of a new court house on Long Island, N. Y., which is a monolithic steel-concrete building throughout, including the roofs. Foundations, walls, columns, floors, roof, dome and ceilings are made entirely of monolithic reinforced concrete, which is continuous, except where shrinkage joints are introduced. If court houses can be constructed thus, it is hard to say why retort houses and works sheds should be more laboriously built.

In the present case, the concrete floor slabs were made of "1:2:3" concrete—one of cement, two of sand, and three of broken stoue—with twisted or flat steel rods imbedded, according to the strength required. The walls were of 1:2:4 concrete, hollow, with 3-inch slabs outside and 2 inch slabs to form the inside surface, connected across the 15-inch air space by ½-inch rods. The roofs are either hipped or flat, with a shrinkage joint at the ridge. A great recommendation of this method of construction is the facility it affords of reviving the dome as a feature of construction. In this way a retort house roof might be made positively handsome, as well as perfectly durable and most appropriate to its various purposes. Iron and slate retort house roofs have surely had their day. It is not the least of the recommendations of a dome (hemispherical) that it is self supporting from the beginning, and is therefore easily built in reinforced concrete. The court house here taken for an example contains about 70,000 cubic feet of concrete, and 80,000 pounds of steel. All the broken stone in the concrete would pass a ¾-inch mesh. It was mixed very wet. The specifications required a sectional area of 1 square inch of steel, and 4 square inches of concrete for every 2,000 pounds of tensile or compressive strain. Speaking of tensile strain reminds one that this kind of stress, hitherto forbidden in sound masonry construction, is quite permissible with reinforced concrete.



An example is supplied by the practice of French engineers in the case of a viaduct on a line between Paris and Versailles, illustrated in the accompanying sections of arches and parapet. It was a question of spreading out the top of the masonry, as shown, over some made ground; and the connection was effected as indicated. A cantilever bracket was thrown out, actually suspended by anchor bolts. The construction of the parapet is also shown. So bold a cantilever construction is unprecedented. The overhang is 12 feet 5 inches. The parapet wall shown is 37 inches high and 4 inches thick in the middle. It is

anchored down every 30 inches by ¾-inch upright rods let into the stone coping. Horizontal wires run from upright to upright. It is, in fact, a wire fence buried in concrete; and it is expected to last as long as it is wanted.

In constructions of this character, neither the bricklayer nor the stonemason has a hand. The intelligence of the designer takes the place of the handicraftsmanship of the worker, which is as it should be in these times. We have here, of course, merely sketched out principles and indicated possibilities. The method, however, brings to builders of retort houses and works sheds the same measure of relief that Mr. Livesey found when he constructed his largest gasholder tank of concrete walls, compiled in the simplest fashion by winter stokers and yard hands. Concrete construction has hitherto been regarded as subject to serious limitations of suitability. The truth is that most of these shortcomings are not those of the material, but of the designer. The preparation of concrete slabs and pillars is an art in which the engineering pupil should delight to employ some of his spare moments; and there is plenty of the best material for the exercise in every gas works. The constructor who can claim to be thoroughly cognizant with the way of building for all purposes in concrete need never go unemployed.

Depreciation, Maintenance and Interest Charges.

By Mr. Reginald P. Bolton.

The comparison of certain different apparatus, the relative economy of competing devices and the value of improvements, are affected directly by the empirical amounts chargeable against them as interest, maintenance and depreciation.

A common and very crude method appears to be to fix each item in such computations at a rate of 5 per cent. In the course of discussions with representatives of power and heat supply companies desirous of applying their systems to certain buildings, I have been confronted with an assertion that depreciation alone should be charged on independent power and heating plants at the rate of 8 per cent., and that interest should be charged upon the whole cost of the installation at the rate of 5 per cent., additional to maintenance at 5 per cent. I have as a result of these varying and apparently haphazard figures been led to make some inquiry into this question, and venture to think some conclusions gained from New York circumstances will be of interest to members of a society especially connected with the design and installation of operating machinery and appliances necessary to life and comfort.

Interest.—In the city of New York the rates of interest on borrowed money vary, of course, with the nature of the security. In the case of buildings and factories the form of security is commonly a mortgage. First mortgages are usually obtainable up to 60 per cent. of the value of the property, and in Manhattan Island at present, a rate of interest of 4 per cent. can be obtained, or in certain centrally situated properties one-half of 1 per cent. lower.

The value of some land is so great that a 60 per cent. mortgage upon its value will suffice to erect and equip a very considerable building upon it, but where this is not the case, an owner borrowing 6-tenths of the cost of his building on first mortgage may borrow the balance, if he be in good credit, at as low as 5 per cent., of banks, on note, bond or second mortgage.

In a close computation, therefore, it should be ascertained what rate of interest the money represented by a plant involves, but where the information is not obtainable it may be assumed that the rate of interest does not exceed 4 per cent. on 0.6 and 5 per cent. on 0.4, or a mean of 4.4 per cent.

Maintenance.—This is compounded of several elements. Cost of upkeep, replacement and precautionary measures. A reasonable amount of care must be assumed in keeping the apparatus in operating condition. Replacement provides for renewal of working parts, and painting of perishable or exposed material. Renewal of inherently renewable materials, such as packing, comes under this heading. By precautionary measures I understand all such steps as require to be taken in good time to obviate in advance the effects of age or decay.

Naturally such items vary very considerably with all kinds of apparatus, and must be taken into separate consideration.

The cost of maintenance, therefore, varies too widely to be stated as a fixed element, but must be estimated for different apparatus by the results of experience and careful foresight. In a very general way 1½ per cent. on the prime cost of a heating and ventilating plant should suffice to cover the above items and on operating machinery 2 to 4 per cent., according to conditions.

Repairs, assuming the term to deal only with accidental damage or breakage or discovery of defects, can be properly covered by insurance or by civil suit, and if not, are to be assumed as an unknown risk. They are not a part of maintenance.

Depreciation.—This is a charge which is calculated to represent the gradual deterioration of a plant, resulting in its eventual wearing out. In certain cases it has been assumed also to represent the supperannuation of a plant, or in other words its loss of competitive power by reason of the advent of improved appliances.

In a general way I consider both these elements are over estimated. It is common to have a sweeping limit of 10 or 15 years assigned as the life of a plant, on one or other of the above grounds. While the policy of clinging to antiquated and unproductive machinery is not in consonance with modern ideas of profitable operation and is not here recommended, it must be pointed out that it is not an argument against assigning a reasonably long life to any apparatus, that its use may be found sooner or later to be less economical than improved apparatus. Such improved appliances will, if sufficiently economical, justify in their results the entire renewal of the existing plant at an earlier date than assigned to it, and the cost of such extinguishment or partial discontinuance is to be borne by, or to become chargeable against the results attainable with the improved plant.

New methods may come into existence at any time and cannot be reckoned with as a fixed element in computing the useful life of any apparatus.

Again, the possibilities of remodeling are, in the case of such apparatus as the members of this Society are concerned in, very often capable of renewing the life of the perishable portions of installations.

Experience in the remodeling of old plants goes to show that even in such machinery as was built a quarter of a century ago, the life of rotating machinery is greater than 20 years, while in boilers of the water tube type, piping, chimneys and much of similar apparatus it may be taken at 25 years. Pumping and hoisting machinery of similar age is quite common, in all cases assuming reasonable care and reasonable renewals for which, as before asserted, separate charges are, of course, to be made.

From the above considerations it may be gathered that in the case of a modern private commercial power or heating plant an assumed life of from 15 to 25 years, varying with the nature of the appliances, is proper, and for the purpose of ready calculation a mean of 21 years can safely be taken.

It is not to be supposed that an owner will regularly lay by annually a sum equal to the amount charged as depreciation, or take the trouble to arrange for its investment and the investment of its interest. It would not, in fact, pay him to do so, because the money is worth more to him in his own business than he could obtain at current rates in the market or savings banks. In practice it is therefore retained in his business or investments, and is earning the rate of interest obtainable therein. In a majority of instances where the business in which the machinery is employed is an actively constructive or manufacturing one, the assumed amount of depreciation is really earning very high rates of interest, often more than 25 per cent. per annum. Under not uncommon commercial circumstances, therefore, the assumed depreciation fund may very moderately be credited with an earning capacity of 10 per cent. compound interest. With a life of 21 years and a rate of compound interest of 10 per cent., the charge of depreciation becomes only 1½ per cent. upon the capital outlay.

It will be evident how important is the consideration of these standing charges in deciding the relative economy of machinery, but it is seldom that they are properly applied. We often learn of the adoption of apparatus designed to effect a certain economy, the cost of which, if debited with its proper charges, would outweigh the ascertained economy and which is therefore being operated at a loss. This is particularly the case in the numerous devices for coal saving in boilers, and guarantees of a certain result are apt to be considerably counterbalanced if the proper charges are applied.

An illustration may be taken from a case recently considered in detail. A high duty pumping plant was offered for a large elevator service with a guaranteed saving of 15 pounds of steam per horse power of water pumped per hour. Careful estimates showed a probable saving in fuel of $1,500 per annum by this apparatus, the additional cost of which amounted, however, to $19,000.

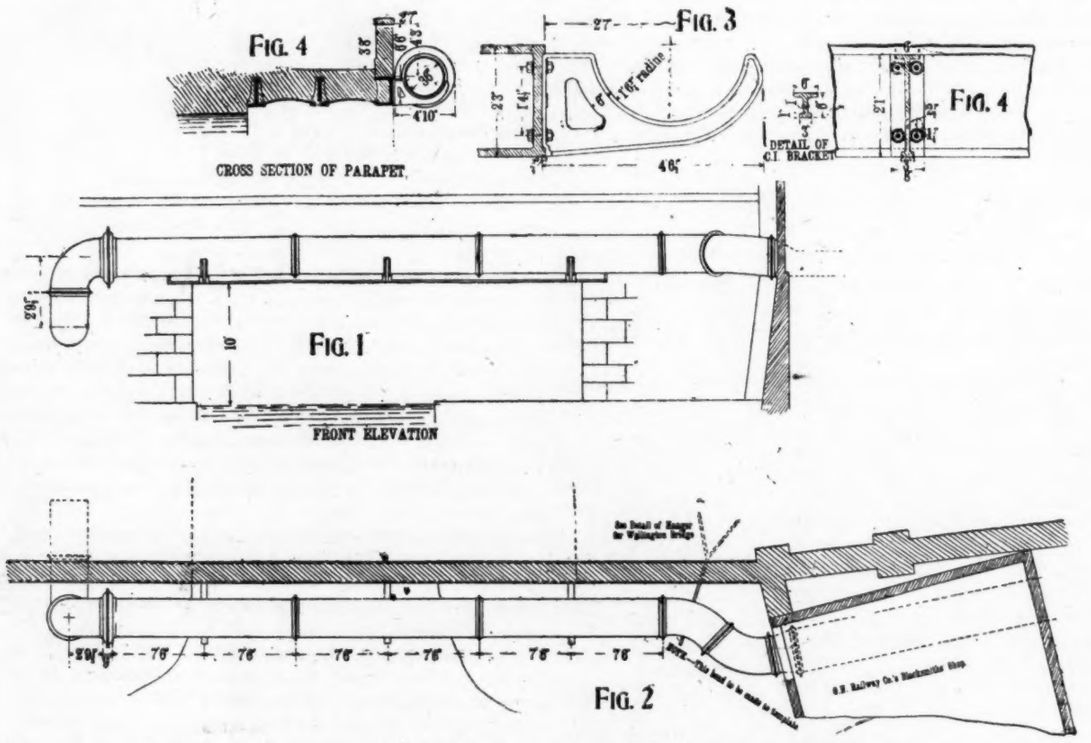
In case the life of the two pumps involved is taken at 20 years, and the rates of interest are as herein stated, the extra capital outlay is to be charged with interest, 4.4 per cent., $836; depreciation, 1½ per cent., $285; maintenance, 3 per cent., $570; additional oil, $70; total, $1,761, showing that the pumps will be run at a loss of $261 per annum, which

capitalized at 4.4 per cent. represents a sum of nearly $6,000. By applying the charges to the saving guaranteed it will be seen that the saving justifies only a capital outlay of $16,780. Therefore to show any gain the cost of the improvement must be less than that figure.

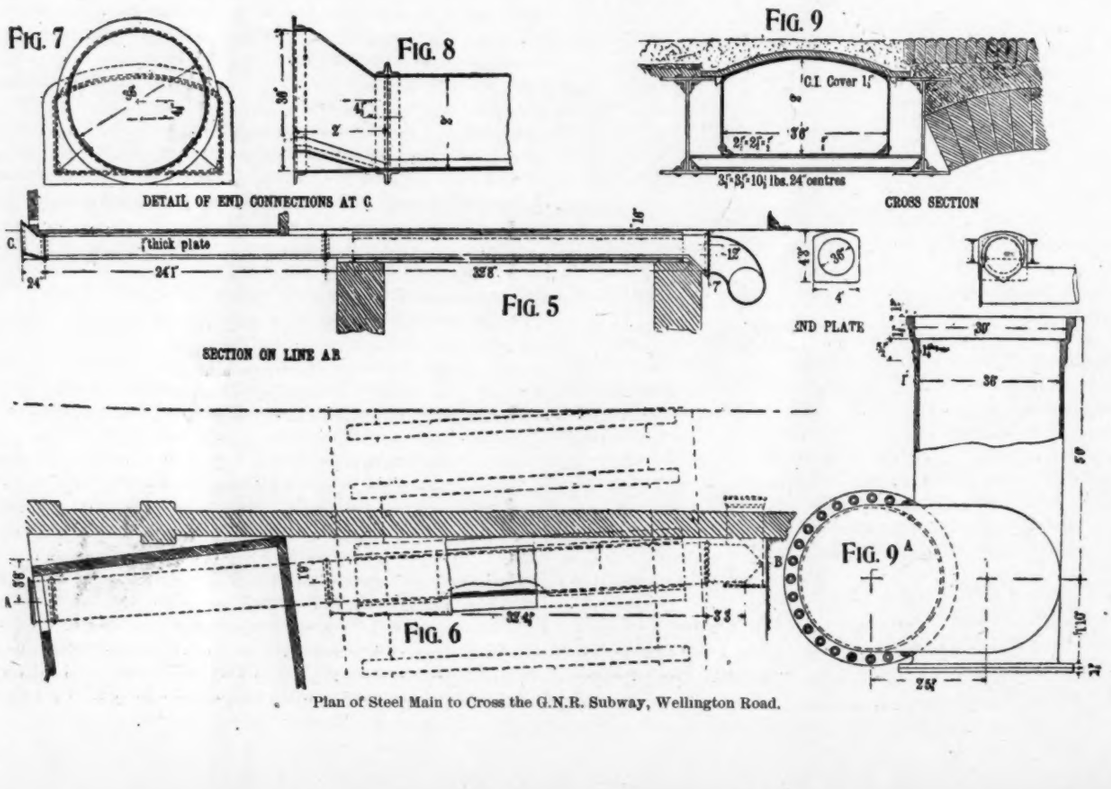
Gas Distribution at Leeds, England.[1]

The gas consumers of Leeds, numbering about 100,000, and scattered over an area of 50 square miles, are supplied, through 860 miles of mains, from three manufacturing stations, one in Meadow lane, the second at New Wortley and the third in York street, and four distributing stations, viz., at Sheepscar, Kirkstall road, Low Wortley and Rodley. The latter are supplied through a system of high pressure mains from the various works. Owing to the great growth of the city in recent years, and to the remarkable development that has taken place in the use of gas for heating, cooking and power purposes, it was found, in the year 1898, that the trunk main system of the city was quite inadequate to the duty demanded of it, and that it needed considerable extensions to bring it up to present day requirements. Many of the service mains, too, were found to be greatly overworked. In the year mentioned Mr. Walter Hole, from Rochester, was appointed Superintendent of the Gas Mains and Distribution Department, and the position of affairs being such as has been indicated, he has since been engaged in initiating and carrying out a scheme of extension and enlargement of mains

1. From the *Gas World*.



Plan of 36-inch Diameter Steel Gas Main to Cross the Leeds and Liverpool Canal in Wellington Street.



Plan of Steel Main to Cross the G.N.R. Subway, Wellington Road.

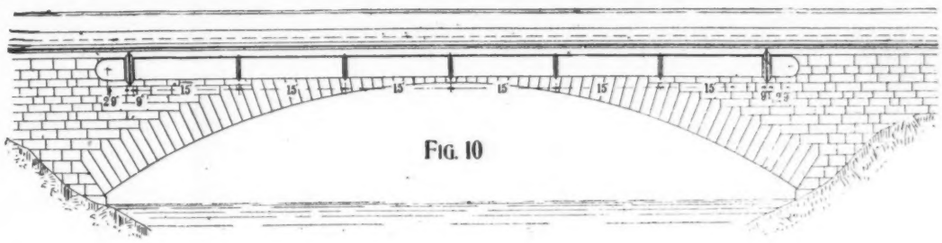
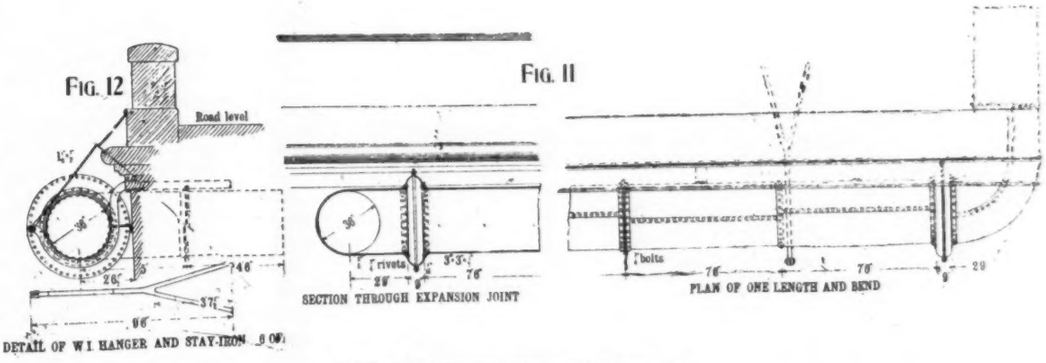


FIG. 10



Details of Steel Connections over Wellington Bridge.

which is of sufficient importance to merit description and illustration.

Work Proposed and Work Done.—Acting on instructions from the Gas Committee, Mr. Hole, in the first instance, prepared a comprehensive scheme for the extension of the trunk main system which received the approval of the Chairman of the Gas Committee (Alderman Lowden), the Deputy Chairman (Dr. Heald) and the General Manager (Mr. R. H. Townsley), and which was adopted in its entirety by the Gas Committee and the City Council. In addition to the ordinary extension of service mains, to meet the normal expansion in the demand for gas, the scheme provided for a complete rearrangement of the trunk mains and for the differential governing of the gas in the high and low levels of the city, including the laying down of two additional 36-inch governors, two additional 24-inch governors, and the replacing of a 24-inch governor by a 36-inch governor. The work was to be spread over 5 years, and the whole scheme involved an expenditure of $558,400. Something like three-fifths of the work has now been carried out, and it is satisfactory to find that notwithstanding the heavy character of the work and the contingencies inseparable from such undertakings, the actual cost has come out at approximately 4 per cent. below the estimates.

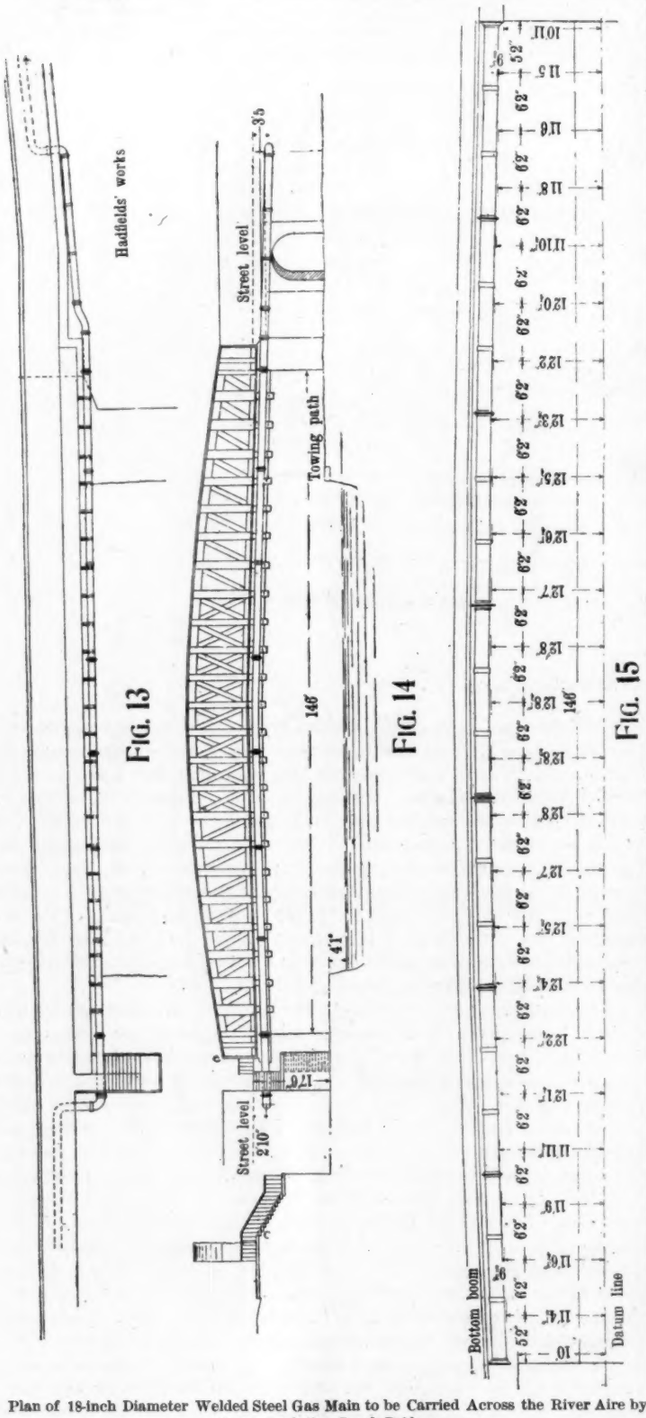
Some Interesting Features.—As some portions of the scheme present rather unique features, a brief description of them will be of general interest. Of still greater interest and utility will be the drawings, reproductions on a reduced scale of the originals, which have been placed at our disposal for the purpose of the present article.

A chief item in the scheme was the laying of a supplemental trunk main 36 inches in diameter, about a mile in length, from the New Wortley works to the center of the city. The principal thoroughfare from the New Wortley works runs, at different points, over the Leeds and Liverpool canal, over the Great Northern Railway Company's subway connecting the main line to goods yard, and over the river Aire. The bridge over the canal is of the old stone arch type, which was widened some years ago by the addition of a girder section. The road above the Great Northern railway subway is carried by iron girders of the usual type, 2 feet deep, spaced 3 feet apart. In the goods yard abutting on the road the girders were found to be spaced much further apart, the distances between each varying from 3 feet 6 inches to 5 feet. The bridge over the river Aire is of massive stone single arch construction. As the cover of the arches of the bridges and the spaces between the girders, either on the roadway or footpath, were much too small to contain the proposed new main, it was decided to carry it outside the bridges altogether and through the goods yard, so as to take advantage of the greater width of the girders there. These sections of the work consist of plain riveted steel pipes, each length—there are six in all—36 inches in diameter, by 15 feet in length, and ⅜-inch thick throughout. The longitudinal transverse seams are ordinary lugs, single riveted, with rivets ¾-inch in diameter and 2-inch pitch. Both ends of the pipes have a solid welded ring of steel angle 3 inches by 3 inches by ½ inch, riveted on to the pipe with rivets of the size already stated. All flanges were machined true on a lathe and had bolt holes drilled ⅞-inch in diameter for 28 bolts ¾-inch in diameter on each joint. All the joints are caulked and made gas tight with red lead. The bends are of plain riveted steel. Two cast iron pipes, which are employed for the purpose of connecting up at either end of steel section, are of 36 inches diameter and 4½ feet long, with flange of 1-inch metal cast on. The cast iron brackets on the stone parapet are six in number, and are of flat iron, 4 inches by 2 inches. All the steel connections received a coat of hot boiled linseed oil at the contractor's works, and afterwards received a coat of oil paint.

The Drawings.—On reference to our illustrations a more precise idea will be obtained of the manner in which the work has been carried out. Figs. 1 and 2 represent elevation and plan of the steel main crossing the Leeds and Liverpool canal, supported by cast iron brackets bolted to girder. Figs. 3 and 4 show details of cast iron brackets. Fig. 4a is a cross section of the parapet. Figs. 5 and 6 show section and plan of ⏛-shaped main running through the Great Northern Railway Company's premises and over their subway. Figs. 7 and 8 show details of connections where the main enters the Railway Company's premises and takes on ⏛-shaped main from circular section. Fig. 9 shows section of main running through the subway, protected with 1¼-inch cast iron arched plates, which also, by means of lugs cast on, take the thrust of top side of girders. A jack arch similar to that shown in the next space was removed to accommodate the main. The main is supported, as shown, by stretchers of 3½-inch by 3½-inch I-iron, carrying wrought iron plates ¼ inch thick. The whole space surrounding the main above and below the arched plates was filled in solid with concrete after the main had been working some time and had been thoroughly tested. Fig. 9A shows connecting bend tee, at point *B*, where the main issues to the roadway again.

Figs. 10 and 11 show elevation and plan of the main over the river Aire, the latter also showing details of concertina expansion joint used throughout. Fig. 12 shows the details of the wrought iron hanger and stay iron, the fork of which was bedded in concrete under the footpath. The whole of these mains have now been working some 18 months without causing the slightest trouble.

Main Over Accommodation Road Bridge.—Another interesting piece of work which has been decided upon has for its object the improvement of the supply of gas to the east end of the city. This is to be carried out next summer. It consists of the carrying of an 18-inch steel main over the river Aire at the accommodation road. Figs. 13 and 14 show plan and elevation of the proposed main, which is to be of ⅜-inch riveted steel plates, and carried by wrought iron brackets and cradles fixed to girders of the bridge, which were left projecting for the purpose by arrangement. Fig. 15 shows, as well as the reduced scale on which the draw-



Plan of 18-inch Diameter Welded Steel Gas Main to be Carried Across the River Aire by Accommodation Road Bridge.

ing is reproduced will allow, the slight curvature which it will be necessary to give to the main to accommodate it to the rise of the bridge.

It may be added that Mr. Hole, to whom is to be assigned the credit for the design and execution of all this work, is a Leicester man. He received his early training under Mr. Charles Robinson, the then Engineer of the Leicester Gas Company, and, after the transfer of the undertaking to the Corporation, in the Corporation Gas Department. He left Leicester in 1884 to take up the duties of assistant outdoor superintendent under the Rochester, Chatham and Strood Gas Light Company, and on the death of the principal in 1891 he received the appointment of district superintendent. Whilst holding this appointment Mr. Hole superintended a considerable enlargement of the distributing plant, including the laying of an additional 24-inch main through the center of the city and of an 18-inch steel main on the parapet and approaches of Rochester Bridge. Twice during this period he received the thanks of the directors, together with handsome gratuities, in acknowledgment of the success and despatch with which heavy and intricate work had been carried out. For the position he now holds, which has afforded him ample opportunity for the further exercise of his skill and resource as a distributing engineer, he was selected from a large number of applicants in, as has been already mentioned, the year 1898.

Some Pointers on Induction Motors.

[By Dr. Louis Bell, in *Elec. World.*]

At the present time the induction motor needs no defence of its general properties, for its has amply proved its capabilities. To a certain extent, however, it does need to be saved from its friends, and brought to the point where the public will look at it as at any other motor and not regard it as in any way a freak surcharged with occult properties.

The writer has always rather "had it in for" the rotary pole treatment of the induction motor, not because it did not substantially represent the facts, but merely by reason of its putting a very unfamiliar face on a motor that is strictly comparable with other motors.

The man who uses an electric motor does not worry himself over the permeability of the iron, the magnetic density in the armature teeth or the specific inductive capacity of the insulation. On the contrary, he does not want to be bored with such technical details, but much desires a good, strong, efficient machine that will do his work well and steadily with a minimum of attention and expense. Such a machine he can find in the induction motor when polyphase current is available, but the average man does not know it in this simple fashion, and judges induction motors by canons that are altogether inscrutable. In the early days of induction motors there was, I am sorry to say, a tendency on the part of many of those who sold them to throw a veil of mystery about them, and to convey the idea that some mysterious hocus-pocus in virtue of a magnetic field whisking around like a kitten chasing her tail, induction motors would do strange and wonderful things in an occult and incomprehensible fashion. Like most false impressions, this has eventually led to trouble, and the development of induction motors has thereby suffered.

For example, take the question of starting current, an objection so often raised to induction motors. No rational man would expect to put an ordinary 110-volt, 10-horse power shunt motor in his shop and then start it successfully by simply closing the main switch. He realizes perfectly well that he would probably blow the fuses or possibly burn out the motor, and, at all events, would get a tremendous current through it, and so, like a rational being, he puts in a starting box. But if an induction motor is in question he eyes it suspiciously, and hints that he understands that it takes an enormous starting current, and will knock out his lights when it is thrown on. If an auto converter is suggested as a means of easy starting, he intimates that it is a pretty mean sort of a motor that compels him to buy and operate that thing, and that if induction motors were any good they would not require it. A starting resistance in the armature circuit he regards as a thing of evil put there to make the best of a bad matter. The last thing that occurs to him is that if a motor did not permit a considerable rush of current when thrown on the circuit at full voltage, it would be a very bad motor indeed as regards efficiency. I have sometimes threatened to make and publish the current curve of a shunt motor trying to start under a load at full voltage, merely to impress this fundamental fact.

In the matter of variation of speed under load the case against popular superstitions is even more amusing. One of the commonest demands on the part of users of induction motors, and smart little engineers who have learned the equations of the rotary field, is that an induction motor shall hold its speed within, say, 1½ per cent. from no load to full load. Now, this not an impossible requirement, and has many times been met, but what would happen if a demand were made for a continuous current motor to fill this specification? The proposition would either be met by a more or less blunt refusal to supply the thing or by a price for special design that would be hair raising. Moreover, such a requirement is in most cases simply foolish, inasmuch as only very rarely is such a regulation of the slightest importance. It can be provided more easily in an induction motor than in any other, but it always implies an extraordinary effort to get as much copper as possible upon the armature even at the expense of considerable inconvenience elsewhere. The customer may imagine that with such a specification he will obtain a motor of phenomenal efficiency, since in both shunt and induction motors the fall in speed under load measures the

loss in the armature; but unless price is no object he may rest assured that when a motor for any kind of current is fattened with respect to one property it will be pinched in others, and he will get about what he is willing to pay for, and no more. In point of fact, no requirement placed upon a designer produces more trouble and expense with a less valuable result to show for it than a very close speed regulation. Hence while the induction motor actually can give wonderful results in this direction, extreme requirements hinder the production of good standard all round machines at a moderate cost, and should never be made unless actually needed.

Another common exhibition of ignorance is in a demand for motors of extraordinarily low speed. Whatever the character of the motor, low speeds mean a larger and costlier motor than would serve at higher speed, and induction motors form no exception to the rule. In fact, they are somewhat more troublesome to design for very low speed than are continuous current motors, since they require an exaggerated multipolar construction that makes it hard to retain a good power factor. In certain cases low speed motors are highly desirable, but they should not be specified to carry out some fine drawn theory, or for the fun of the thing, unless one is willing to pay for them.

If one looks over the list of standard motors for continuous currents as produced by any manufacturer he will very quickly perceive, by an examination of dimensions and weights, that a low speed motor is generally merely the next larger size of standard speed motor differently wound. In the case of induction motors such an arrangement is not feasible, and the result is unusually an extreme multipolar design that demands a phenomenally small air gap if the power factor is to be kept up. The only thoroughly bad induction motors, which the writer has ever of late years examined have been machines hoodooed, so to speak, by the attempt to get abnormally low speeds in comparatively small motors. A similar attempt in continuous current motors leads to costly machines of low efficiency, but for some occult reason the average man swallows a low, real efficiency in continuous current motors without making any fuss, but kicks like a mule at low apparent efficiency in an induction motor.

A high power factor is very desirable in an induction motor, and should be helped and not hindered whenever possible. Within reasonable limits it is comparatively easy to obtain unless some extraordinary demand for unusual properties in other respects comes in the way. But it is a matter of design interconnected with all the other features of the motor, and can be crowded out if pushed too hard.

In some respects induction motor design is easy. The absence of the commutator with the elimination of all questions of sparking is an enormous advantage in modifying the machine to suit various requirements, but all design is a series of compromises, and when the property is exaggerated some of the others are necessarily curtailed.

When a freak specification calls for a 10-horse power motor of 360 r.p.m. at 60 cycles, to vary 2 per cent. in speed between no load and a 50 per cent. overload, and to have a power factor of not less than .90 at full load, the designer has his work cut out for him, and if he comes anywhere near to filling the requirements, the resulting motor will not be one, the building of which should be encouraged in point of quality or price.

The loudest objection raised against induction motors at the present time is their cost. Built as they are of piles of high grade laminated iron, they need all that can be gained by the abolition of the commutator, and the simplification of the armature windings to come out even with continuous current machines, particularly since their field winding is difficult.

But the largest factor in keeping up their price to-day is neither material nor intrinsic labor cost, nor monopoly, but the inherent foolishness of those who continually howl for all sorts of outrageous special designs—designs which imply great added expense. Special machines are sometimes necessary, and can be readily obtained in induction motors, as elsewhere, but I know of no branch of electrical industry that has been so infected by a mania for freaks.

Ordinary continuous current motors have settled down into fairly regular lines of manufacture, and when anything far outside these lines is required it can be obtained, but as a special machine at a considerably increased cost. The same is true in general machine production. One can buy standard lathes, for example, to meet all ordinary requirements at reasonable prices. But if some long-haired and fussy old personage insists on having one a little different from anything that the mind of man has yet devised, he must have a long bank account. I have had occasion from time to time to get many quotations on special work, and I am bound to say that electrical manufacturers in general make less fuss about it and add less cost than those in most other lines.

For the good of the art special machines should be used only when they confer some really material advantage. It is hard to see why the demand for alternating motors should be more diverse than that for continuous-current motors, but it certainly happens to be, and while this condition remains manufacture cannot settle down to the steady lines that insure low art of production. Users of motors, and engineers as well, ought to realize that specialization is cheap only on a very large scale, that is, when special and regular work merge into each other. And in induction motors this condition is far from being realized, hence the average costs are undeniably high when judged by comparison with standardized continuous-current motors.

How to Use the U-Gauge.

The Denver (Col.) Gas and Electric Company has issued to its employees the following instructions for using the U-gauge to assist in locating causes of complaints:

Employees in the gas department must familiarize themselves with the U-gauge, which can be made of great value in locating causes of complaints arising in the use of gas appliances, and especially fuel appliances. Congestion in the service pipe, meter, or meter connections, is often the source of unsatisfactory results, and may cause excessive bills. Every gas appliance has some favored rate of gas consumption at which it will do the most economical work, and generally the most satisfactory work. A stoppage in the pipe may reduce the flow to a rate much below this.

In measuring pressures for obstructions we are most interested in the drop in pressure between two points, and not in the absolute pressure. To locate the point of congestion in the supply pipe, the gauge should be attached at the furthest point from the source of supply, the street main, and enough gas used at some point remote from the source of supply to cause a considerable fall in pressure; then, by successively attaching the gauge at points nearer and nearer the source of supply, the congestion may be located, providing all the congestion is at one point. The point of congestion will be readily noticeable by reading the pressures on the U-gauge. If the fall in pressure is considerable but uniform from point to point, it merely indicates that the quantity of gas flowing is greater than the capacity of the pipe, but if a particular drop in pressure occurs between two points, it clearly indicates that the congestion exists between these two points.

This drop in pressure must necessarily be influenced by the quantity of gas demanded or in use. Assuming that you have, say, 20-tenths pressure in the main, you will have at this same altitude in the house exactly the same pressure, provided no gas is being used, even though there is a passageway only as big as a pinhole at the congested point. If gas is being used, the pressure is dependent upon the quantity flowing, hence to determine whether serious congestion exists in the pipes, the pressure must first be measured, at some convenient point in the pipe, with every burner on the premises turned off, and must again be measured at a point remote from the street main with the maximum quantity of gas flowing, and which is, therefore, demanded. If an excessive drop in pressure occurs, the pipe is either obstructed or too small for the quantity of gas flowing.

The drop in pressure will be as the square of the gas flowing. As an example: Say you had flowing 20 feet of gas per hour, and the drop in pressure was 2-tenths of an inch; then to find the drop in pressure for any other quantity of gas you would multiply 20 by 20, and the ratio of this product to the square of any other rate of flow would represent the ratio between the two drops in pressure. We have, for instance, in one case $20 \times 20 = 400$, which we have found corresponds to a drop of 2-tenths of an inch; now, should we want to determine the drop with 40 feet of gas flowing, we would multiply $40 \times 40 = 1,600$. As 1,600 is four times as much as 400, the drop in pressure would necessarily be four times as great, or 8-tenths of an inch.

Serious fluctuations in pressure will be apt to alter the time required for any appliance to do a given amount of work. It may even reduce the flow of gas to a point where the appliance will not do the work for which it was intended. Generally speaking, the best results in fuel gas appliances using a Bunsen burner are obtained with the maximum pressure of gas, provided the supply is not checked by any valve or stopcock, but is checked entirely by the size of the gas orifice in the burner. This is due to the fact that the Bunsen burner operates on the principle of induction, and the inductive effect is greatest when the velocity of the gas issuing from the orifice is greatest. If all of the pressure contained in the gas is distributed in the Bunsen burner it tends to produce a more intimate mixture of gas and air, and the more intimate this mixture becomes the more intense will be the combustion and the higher the flame temperature.

The Principle of "The Surplus Product."[1]

Commissions and committees of inquiry in the United States often follow methods of procedure which appear somewhat strange to British eyes. The Federal Industrial Commission has recently issued a special report based upon data received in reply to circulars of inquiry issued to a large number of American manufacturers. The object of the circular was to ascertain whether there was any truth in the allegation, frequently made, that American manufacturers sell their products to foreign purchasers at prices lower than those charged to native customers.

The question is one that closely interests British manufacturers, especially those engaged in the steel trade or other industries in which the product is large and involves the keeping up of a big establishment. The Commission communicated with over 2,000 firms, the scope of whose operations extended over a wide field of industry, and twelve questions were put to each person or firm addressed. The substance of the chief points brought out in the answers are given in the Commissioners' report, but in every case names are suppressed. This method of obtaining information has its drawbacks, but an excuse for the procedure is that information is thus forthcoming which could not otherwise be obtained at all. The matter supplied seems often to bear evidence of the bias of the contributors; and whether it is worth while giving an official complexion to anonymous views of this nature is a matter which may be open to discussion. The Americans, however, often display a boldness and freedom from conventionality in the conduct of official business which is well recognized, and it is well understood that the value of these publications should be appraised according to the circumstances under which they are compiled, the officials trusting to the shrewdness of the American public to allow any reasonable discount that may be needful before the views put forward are accepted for use.

The two most important questions put by the circular were whether the recipients were in the habit of selling to foreign markets at lower prices than those charged at home; and, if so, what was the reason. Opinion was also solicited as to what course would be suggested to secure for home customers equality of price with that charged in foreign markets by the same producers for the same goods.

For some time past an increasing feeling of dissatisfaction has been growing up in America at the prospect of the working of the "surplus product" system. As our readers are aware, the policy of a number of American owners of large factories is to keep their establishments fully employed in times of depression at home by selling the surplus of production, in excess of that required for home use, to foreign purchasers at prices, if necessary, below those charged to the American purchaser. In this way the home market will be sustained at a pace that will supply a profit, even though there may be none on the foreign sales. It will be evident that this "principle of the surplus product" can only be carried out in a country that maintains a protective tariff. It is difficult to understand how the American consumer is not to be at a disadvantage.

The big trusts and combines are the great upholders of this system, and it is probably that which has chiefly led to their growing unpopularity, to which we have already alluded. Although the replies to the Commissioners' circular were doubtless penned before the latest developments of the big trust movement were made known to the public, yet one can almost fancy one recognizes a desire on the part of manufacturers to meet public opinion in this respect.

Although a good many of the answers of those addressed by the circular would lead one to suppose that the prices obtained by the American manufacturer from abroad are as high as those ruling in the home market, other witnesses acknowledge that the rule of the surplus product is in operation. To whatever extent that may be so at the present time, we may be sure the system will be far more extensively followed when the power of production exceeds home demand to a larger extent. Various reasons are given why lower prices are accepted for export orders than for domestic supplies. Some of the manufacturers say that the reason by which they are governed is simply to swell output. The foreign demand enables the production to be so increased that the cost of manufacturing is greatly reduced, and in this way the home consumer gets a benefit. If a works, by aid of foreign orders, makes 2,000 tons of steel, whereas the home market would only demand 1,000 tons, and the 2,000 tons can, naturally, be made more cheaply than the 1,000 tons; then, even if no profit is made out of the foreign trade, the home demand can still be supplied at a lower price than would be possible if the smaller quantity only were produced. This is a very pretty argument, and no doubt it may be logically advanced to prove that the world at large would benefit by such a transaction; but the policy would aim a serious blow at the foreign trade of any country following such a course. For instance, if plates and angles of American make were sold in England at a lower price than in the United States, it is evident that British shipbuilders would be in a position to underbid American shipbuilders in the markets of the world, even supposing all steel were made in America. It cannot be denied that the larger output due to the surplus product system would enable the American maker to produce steel for the home market at a cheaper price than would be the case if he made in smaller quantities; and so far the American consumer might profit, though that would be by no means certain; but how much more advantageous it would be to the country to reduce prices by throwing down the barrier of protective duties, thus giving the American shipbuilder the advantage of American steel as cheap as the European could buy it, and thereby assisting him to compete in the markets of the world.

The old plea for a prohibitive tariff—that an infant industry needs protection—no longer applies to the steel trade of America. Rich ore, cheap coal, and the wonderful way in which native enterprise and ingenuity have developed the steel making resources of the country, placing their works at the head of those of all the world, make it ridiculous to urge that American steel makers need protection. It may have been wise for America, beginning with a fundamental industry, years ago to have protected steel makers against British assault, and, taking only a single instance, thus to have sacrificed for a time the chance of a foreign trade in shipbuilding. Now that the steel industry is no longer an infant, but has reached the proportions of a giant, overtopping its fellows in all other parts of the world, the swaddling clothes of protection have become absurd.

We are conscious these arguments may be used against our own interests; and, so far as British prosperity is concerned, if the United States will supply us with steel at cost price, or half cost price, forever, this country can ask nothing better; unless it were they should supply it to us for nothing at all; a pitch of altruism to which even the "surplus product" is not likely to attain. As we have pointed out on a former occasion, however, we must be careful that the surplus product system is not continued only just long enough to kill our native steel industry. In that case we should be quite at the mercy of the foreign producer, who would, doubtless, show no more consideration for us than for his fellow-countrymen. Again, it may be that, owing to the natural riches of the country, America is destined to have the steel trade of the world in any case—there are American steel makers who hold this view—and in such an event we can only pray that the United States will continue the surplus product policy for all time. These are some of the aspects for and against the policy from the standpoint of British interests. For our own part, reviewing as far as possible the chief facts of the case—and being by no means of opinion that British steel makers are as much at the mercy of American competition as some would have us believe—we look on the surplus product in the light of an imaginary "gift from the gods," and we should be as simple as the foolish Trojans were we to welcome it within the walls of our citadel. Whether we can do anything to keep it out is another matter. A Free Trade policy, wisely or not, throws down our chief barrier, and blunts the one weapon of defence.

We say "wisely or not," because we remember that England does not stand alone as a possible market for American steel. Even if we denied our manufacturers its use, the surplus product might be sold to other countries—some, perhaps, our competitors in shipbuilding and other steel using industries—and we should thus possibly throw aside an advantage that might only be too eagerly seized by others. The whole argument is, of course, based on the assumption that American steel is sold in European countries at cheaper rates than it can be made by them. We form no conclusions; the case is too complicated by an obscure future; there are too many uncertain factors and unknown quantities. We merely put the matter in different lights, viewing it from various standpoints as they occur. If, however, there is one conclusion that appears more obvious than the rest, it is that the policy of the surplus product in steel making can hardly be to the advantage of the American people; so long as it lasts.

Some of the manufacturers who reply to the Commissioners' circular state that the difference in price of American goods in favor of the foreign purchaser is far less apparent in the present day than it was in past years. That may be true; but it must be remembered that for some time United States manufacturers have been experiencing a period of altogether unprecedented home demand, and the surplus product system is only intended for times of domestic slackness. In those cases in which it is acknowledged that foreign rates are lower, reasons are given, many of which remind us of the excuses offered here at home by British shipowners and railway companies for favoring foreign goods

1. *Engineering*. London, Eng.

in the matter of transport. Foreign orders, those who reply to the Commission's circular say, are in larger bulk than those of the home market. The transactions are made with merchants or agents who pay cash promptly, and who take all the minor worries of the business on their own shoulders. Distribution is arranged for by the middle man; packing in small quantities he undertakes, also the payment of freights, of customs duties, and many other services which are not only troublesome, but costly.

Putting forward these considerations seems a little like begging the question, and the answers emphasize the defect of inquiry by circular. The real question at issue is whether the foreign consumer gets the article at a cheaper rate than the native user. Does the American manufacturer allow an excessive margin to the middle man, and so enable the latter to supply American goods to the foreign user at prices lower than those charged to the American user? Some of the witnesses answer this question in the negative; but, if this be true of the business at large, facts have been very much distorted of late, and some American manufacturers have failed to carry out a declared policy.

Others who have replied to the inquiries of the Commission say that they have accepted lower prices in order to compensate for tariffs of other countries—a reason that may arouse mixed feelings in the minds of both Free Traders and Protectionists. We have here a somewhat complex problem. A country—in this case the United States—protecting its manufacturing industry by a prohibitive tariff, with the not unexampled result that the native consumer pays the taxes of a foreign State. Supposing, for instance, Montreal takes 1,000 tons of steel from Pittsburg. The price the Pittsburg would charge his own countrymen would be, say, $50 a ton. But there is a Canadian duty of, say, $5 per ton, so the Pittsburg steelmaker charges but $45 to the Canadian purchaser, and recoups himself by an extra charge to the home user.

Here are arguments for and against Free Trade; for and against Protection. The Canadian Protectionist says: "See, we get our taxes paid by the United States!" That is in favor of Protection; but the United States Free Trader will say, "Look how Protection is ruining the country. Our prohibitive tariff keeps out foreign competition, and enables our steelmakers to force the United States consumer to pay Canadian taxes!" Of course, the principle may be reversed on some other transaction, and in the meantime the consumer in a third country, where there is no Protection, may be getting steel at $45 net, and so, for a time, may undersell both the American and the Canadian in a neutral market. But only "for a time." One of the reasons for the adoption of "surplus product" methods given in the answers to the circular was that in order to establish a foreign market lower prices were accepted abroad in order to oust the native manufacturer. After the market had been captured, prices could be raised.

Only a few of the replies to the circular state bluntly and without excuse that they sell more cheaply abroad than at home because foreign prices are lower, and that they can only do business on these terms. Cash payment for exported goods—as compared to long credit and possible bad debts in America—and the cheaper labor of Europe are frequently advanced as reasons why prices are lower on this side of the Atlantic. It is difficult to reconcile the latter statement with the constant boast of America that, though higher wages are earned there, yet the workman of the United States is so superior in efficiency that his energy and skill more than compensate for the extra money paid for a day's work. Another reason given for low prices for export is worth notice. There is a drawback on imported raw material which is worked up in the United States and then again sent abroad. This provision appears wise and liberal. It is rightly assumed that there are certain classes of raw material that can be more cheaply made and sold by other countries than they can be produced in America.

The Americans are anxious to cultivate a foreign trade, but if their manufacturers have to pay a heavy duty on some items of raw material, they cannot expect to compete with those—ourselves for instance—who get that particular class of goods duty free. Hence the return of duties paid, which seems equitable enough. A certain amount of trade is brought into the country that would otherwise be missed, and no one loses anything. If, however, we look closely, doubts may arise as to the wisdom of the measure. It will appear that the lower price charged by the American exporter to the foreigner enables the ultimate purchaser—probably a manufacturer—to produce his wares at a rate below that of the American manufacturer of similar articles; and thus American trade suffers. For example, fine steel can be bought from Sheffield at a lower price than it can be procured in the United States. A New England toolmaker may import, say, a ton, paying duty, and may make it into small tools. One half of these he sells at home, charging the enhanced price necessary to cover the duty; the other half he exports to England, charging a lower price, and getting the greater part of the duty refunded by the Customs authorities. It is evident that the British users who purchase the tools will be so far in a better position than their American competitors, and, other things being equal, will keep the latter out of neutral markets.

The whole inquiry illustrates the vast complications of the subject, and how easy it is to adduce or refute arguments for or against a Free Trade or a Protectionist policy respectively; and it is upon a prohibitive tariff that the system of the surplus product depends. If we leave theory and turn to practice, we are equally at a loss. During half a century of free trade Great Britain has built up a commerce the extent of which other countries have never yet equalled; but, on the other hand, during a much shorter period of time, the United States, with a rigid system of prohibitive duties, have established branches of industry which in some cases have already outrivalled our own; whilst in many others they are fast reducing the lead we hold. In Germany, too, another Protectionist State, the same conditions appear, though to a less marked degree. Of England it may be said, in accounting for our success, we had a long start in the industrial race. We were in the happy position of being able to develop our industries earlier than all other countries. We made the first engines, the first steamships, the first railways, the first textile machinery, the first blast furnaces, the first open hearth steel, the first machine tools. We speak, of course, from the modern industrial, not from the historic point of view. We had Arkwright, Watt, Stephenson, Penn, Elder, Neilson, Bessemer, Whitworth, Nasmyth, and a host of other great men; together with the ardent workers that they collected round them and inspired by their example. (We also had Thomas, but he came in later days, and his brilliant work has been turned against us.) With these advantages it may be that the country would have prospered even had Cobden and Bright lost their cause.

On the other hand, America has had advantages that may have made her prosperous in spite of the Protective policy under which she has grown so rich. There was the vast and rich extent of virgin country; the constant accession of young and vigorous manhood, which the older nations have been at the cost to rear, for the development of her resources; there are the great natural riches—coal, iron, timber, grain, and copper, in a profusion that no other country can boast of having developed. These things may have made America prosperous even though her fiscal policy may have been unwise.

These disturbing factors, or unvalued quantities, make it as difficult for economists to prove the superiority of either one system over the other by the witness of example as apparently it is by the evidence of inductive reasoning. We are at a deadlock for want of a crucial instance. In Great Britain Free Trade has become a matter of faith—almost a religion; to us the rest of the world are political infidels, or, at best, agnostics, who are blind to the truth. Nevertheless, the rest of the world contains a few quite intelligent persons.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE capital stock of the General Gas Light Company, of Kalamazoo, Mich., has been increased to $170,000, from $80,000.

MR. CHARLES JOHNS has been appointed Cashier to the Tacoma (Wash.) Gas Company.

THE estate of the late Mr. Harvey W. Brown, well known to the fraternity as the President of the Minneapolis (Minn.) Gas Light Company, has been appraised at $315,000.

"V. W. H." is informed that the annual meeting of the Peoples Gas Light and Coke Company, of Chicago, will be held at 11 A.M. of next Monday.

THE Water and Light Board, of Duluth, Minn., has determined to double the capacity of the generating plant of the municipal gas works.

THE ordinance of the proposed Sterling (Ills.) Gas and Electric Light Company has been amended by a declaration that "On and after December 1, 1902, the rate of gas used for any purpose or purposes shall not exceed $1.35 per 1,000 cubic feet, with a deduction of 10 cents per 1,0 0 cubic feet in case the bill therefor for each month shall be paid by the 15th of the month next succeeding the month when the gas was consumed." The original ordinance provided that the Company might not charge in excess of $1.50 per 1,000 cubic feet for an illuminating supply, the charge on fuel supply account not to exceed $1.25 per 1,000.

A CORRESPONDENT forwards the following clipping from a Boston newspaper: "The effort making by interested parties to secure a controlling interest in the Waltham (Mass.) Gas and Electric Light Company, at about $1.20 per share, has been choked off by an official circular sent to all the shareholders advising them not to part with their stock."

MESSRS W. N. MERRILL and W. J. Zitterell are still actively engaged in the attempt to secure a franchise for the operation of a gas works in Webster City, Ia.

MR. GEORGE KEATON, Superintendent of the Gilroy (Cal.) Gas Company, has announced that, as soon as the permanent users of gas, as shown by the Company's books, are increased in the number of 10, the rate will be reduced from $3 to $2.50 per 1,000. That would seem to be a liberal offer, even if it does savor of peculiarity.

At the annual meeting of the Norwich (Conn.) Gas and Electric Company the following officers were elected: Directors, C. Henry Osgood, F. T. Brown, Arthur H. Brewer, Stephen B. Meech, George E. Terry, A. M. Young and Morris F. Tyler; President, C. H. Osgood; Vice-President, George E. Terry; Secretary and Treasurer, A. M. Young.

The gas plant of the Peoples Gas and Electric Company, of Defiance, O., is pretty well along towards completion.

The Cincinnati Gas and Electric Company has purchased the plant and rights of the Wyoming Electric Light, Heat and Power Company, which has been supplying electric currents in the Cincinnati suburbs of Wyoming and Lockland.

The regular monthly dividend of 1½ per cent. on the shares of the Peoples Gas Light and Coke Company, of Chicago, is payable the 25th inst.

At the annual meeting of the Grand Rapids (Mich.) Gas Light Company the officers chosen were: Directors, J. M. Barnett, A. G. Hodenpyl, Henry Idema, Emerson McMillin, T. J. O'Brien, J. Boyd Pantlind, L. J. Rindge, A. D. Mackie and H. D. Walbridge; President, H. D. Walbridge; Vice-President, Emerson McMillin; Secretary and Treasurer, H. B. Wales. The office of Second Vice-President was abolished—it had been held by Mr. McMillin—and that gentleman was promoted to the place of First Vice-President, which position became vacant through the death of its former incumbent, Mr. Noyes L. Avery.

A correspondent in San Francisco, Cal., writing under date of January 22d, incloses the following: "Rudolph Spreckels was in control at the annual meeting of the shareholders in the San Franoisco Gas and Electric Company at its annual meeting yesterday. He did not use his power to more than the extent of electing the majority of the Board of Directors, making a change in his following in the directorate and organizing the new Board. Such old timers as Adam Grant, Levi Strauss and Joseph B. Crockett were retired. Thomas B. Bishop gave way to Edward J. McCutcheon as the last named attorney is in better accord than the former in the policy of Rudolph Spreckels, and several other new men were chosen. Had he so desired the young millionaire might have been President of the San Francisco Gas and Electric Company, but he preferred being simply pilot with another man at the helm, so that the new Board of Directors and officers selected were as follows: William B. Bourn, President of the Empire Gold Mining Company, President; A. H. Payson, Vice-President; George H Collins, William J. Dutton, Frank B. King, Edward J. McCutcheon, Louis F. Monteagle, J. Downey Harvey, C. Osgood Hooker, Daniel T. Murphy and Rudolph Spreckels, Directors, with J. B. Grimwood Secretary in place of William T. Barrett, who has filled that position for 40 years. The policy of the new regime is stated to be rigid economy. The meeting was a long one, but was devoid of incident. Everything had been arranged in advance. A. H. Payson, Vice-President and acting President, was in the chair. The report of the President showed that during last year the sales of gas were 92,535,000 cubic feet, a gain of 10 per cent., and that the sales of electricity had been 1,361,309 kilo watts, a gain of 12.9 per cent. The numbers of gas consumers was given at 34,271, a gain of 3,462, and that of electric consumers as 4,286, a gain of 1,961. The business of the stove department grew largely in consequence of the low price of gas, and the sales of coke, tar and ammonia amounted to $101,069.84. The President also reported that improvements had been made in the electric plant by which a saving of from $100,000 to $125,000 annually had been effected. The business of the gas department was declared not to have been so fortunate, but it was said that by purchases of coal, oil and other arrangements for the current year a saving of $150,000 would result. The President's report concluded with the statements that $20,000 would have to be expended on the additional water gas plant as it was intended to entirely abandon the manufacture of coal gas, and that the San Francisco Gas and Electric Company now owed $315,000 to the San Francisco Gas Company, $132,562 on uncompleted contracts, and that there was an overdraft against it of $133,707, against which there were uncollected gas and electric accounts of $153,000. The financial statement presented by the Secretary was as follows:

Assets.

Real estate, construction and plant	$9,708,573.33
Pipes, conduits, lamps and meters	4,365,381.29
Patents and licenses	150,000.00
Oil, coal, etc	119,137.65
Cash on hand	16,741.71
Sundry assets	58,882.13
Supplies, tools, etc	$122,195.41
Amounts due from consumers	119,196.06
Amounts due from sales of residue, etc	28,967.54
Total	$14,689,075.12

Liabilities.

Bonds	$623,000.00
Interest on bonds	7,415.00
Unpaid dividends	7,605.12
Pay rolls due	33,149.80
Sundry credits	252,854.88
Bills payable	315,000.00
Deposits on gas and current	43,512.21
Depreciation and reserve fund	412,253.75
Capital stock	12,994,284.36
Total	$14.689,075.12

The offices of the Westerly (R. I.) Gas and Electric Light Company are to be removed to a building that is being constructed on Broad street, adjoining the First Baptist Church.

At the annual meeting of the shareholders in the Marshall (Mich.) Gas Company the following officers were elected: Directors, H. W. Douglas, S. T. Douglas, A. C. Fox, Moses Seabolt and C. E. Hiscock; President, Moses Seabolt; Vice-President, C. E. Hiscock; Secretary and Treasurer, H. W. Douglas.

It is thought that gas will be supplied to the residents of Brookfield, Mo., by March 1st. Manager Stephens declares that the delay is directly chargeable to the dilatoriness of the contractors for the iron work.

The report of the United Gas Improvement Company, in connection with its operation of the Philadelphia gas works, for the quarter ended December 31, 1901, shows that the payment made to the city on royalties account for the period named amounted to $109,110.89, an increase of $13,600 over the sum paid for the corresponding quarter of 1900.

The *Gas World* declares that competition of American coal against British coal at Bordeaux, France, has been reported on by his Majesty's consul at that port. In 1900, of 850,000 tons which were imported, 840,000 were from the United Kingdom and the remaining 10,000 tons from the United States, as ballast. In 1901, in addition to this ballast coal, of which 1,500 tons were brought in by the last steamer, 2 cargoes arrived, one of which, 3,600 tons, in a British steamer, and another of 5,000 tons. There is little to choose between the best American and the best Welsh coal as regards quality. It appears to be the excessively low freight at present that allows the American coal to be imported into Bordeaux. The two cargoes above mentioned paid $2.13 and $2.38 a ton as compared with $1 from Cardiff. The consul adds that he believes that for gas making purposes American coals cannot, at present at any rate, enter the market against English gas coal. His Majesty's consul at Marseilles, France, has also sent in a report to the Board of Trade on the competition of American coal in the Mediterranean. According to this report the imports of American coal at Marseilles have increased very rapidly during the past 3 years. Rising suddenly to 118,491 tons in 1900, the quantity imported from the United States during the first 9 months of 1901 reached 175,000 tons, and it is estimated that the total for that year will have exceeded 200,000. In the opinion of the consul the competition will only become dangerous if high prices continue in England, and if the American shipping interests succeed in securing the passage of the Bounty Bill in 1902. In that case he fears the Americans will get the chance of capturing the Mediterranean coal trade. It was the exorbitant prices in 1899 and 1900 that gave the Americans their opportunity. He holds, however, that the present competition is not a serious matter.

At the annual meeting of the Laclede Gas Light Company, of St. Louis, Mo., Mr. Festus J. Wade was chosen to succeed the late Mr. George A. Madill. No other change was made in the former executive management.

The payment made by the Cleveland Gas Light and Coke Company into the city treasury, for the half year ended December 31, 1901, on royalties account, amounted to $32,788.61.

At the annual meeting of the Gas Company, of Luzerne County, Pa., the officers elected were: Directors, Abram Nesbitt, J. W. Hollenback, E. W. Mulligan, E. H. Jones, John Flanigan, J. A. Stearne, Liddon Flick, E. C. Jones and C. E. Stegmair; President, Abram Nesbitt; Vice-President, J. W. Hollenback; Secretary and Treasurer, E. W. Mulligan; General Manager, John Flanigan.

The Market for Gas Securities.

There was little animation in the trading in local gas shares since last time of writing, but prices were fairly well maintained. The annual meeting of the Consolidated Company was a very tame affair, the former Directors being named to succeed themselves. The figures submitted to the shareholders, in respect of the year's business, were meager and vague, but they seem to show that the total receipts for the twelvemonth amounted to $25,000,000, of which $17,000,000 may be credited to the gas end of the enterprise, $8,000,000 going to electric account. The most remarkable thing in connection with the report is that it shows a per capita consumption of 7,600 cubic feet per annum. The financial position of the concern would seem to be impregnable. At the close to-day (Friday) Consolidated was 217 to 217¾.

Brooklyn Union was absolutely featureless. It is nominally 212 to 217. Peoples, of Chicago, is somewhat weaker. The regular quarterly dividend of 1½ per cent. on it has been declared. Washington (D. C.) gas is again beyond the 350 mark, and quite some transfers were made in Baltimore gas at a point above the figures of a week ago.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

FEBRUARY 3.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	217	217¾
Central Union, Bonds, 5's.	3,000,000	1,000	109½	111
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	115	118
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	310	315
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co..				
Bonds, 5's	11,000,000	1,000	109½	109¾
Northern Union, Bonds, 5's.	1,250,000	1,000	106	108
New York and East River..				
Bonds 1st 5's	3,500,000	1,000	111	115
" 1st Con. 5's	1,500,000	..	109	111
Richmond Co., S. I.	348,650	50	100	..
" Bonds	100,000	1,000	103	..
Standard	5,000,000	100	130	135
Preferred	5,000,000	100	150	155
Bonds, 1st Mortgage, 5's	1,500,000	1,000	118	..
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	212	217
" " Bonds (5's)	15 000,000	1,000	119	119½
Bay State	50,000,000	50	⅝	¾
" Income Bonds	2,000,000	1,000	.	75
Binghamton Gas Works	450,000	100	28	30
" 1st Mtg. 5's	509,000	1,000	93	96
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	8½	10
" " Bonds, 5's	5,250,000	1,000	79	80¼
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	
Central San Francisco	2,000,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati Gas & Elec. Co.	29,500,000	100	100½	101½
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	106	107
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	60	65
Preferred	3,026,500	100	84	86
Consumers, Jersey City Bonds	600,000	1,000	102	103
Consumers, Toronto	1,700,000	50	218	225
Consolidated, Baltimore	11,000,000	100	63½	64¾
Mortgage, 6's	3,600,000	..	..	115
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	12	14
" Con. Mtg. 5's	380,000	1,000	79	83
Consolidated G. & E. Co.'s., Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co.	4,825,500	50	.	89
" Prior Lien 5's	5,603,000	1,000	99½	100
Detroit Gas Co., 5's	381,000	1,000	89	89½
" Inc. 5's	16,000	100	94	94½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	34	38
Fort Wayne	2,000,000	..	..	.
" Bonds	2,000,000	..	53	55
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	102	104
Hartford	750,000	25	245	265
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	101	103
Indianapolis	2,000,000	..	60	64
" Bonds, 6's	2 650,000	..	99½	101½
Jackson Gas Co.	250,000	50	68	71
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	90	92¼
Preferred	2,500,000	100	108	110
Bonds	10,000,000	1,000	..	108½
Lafayette Gas Co., Ind.	1,000,000	100		60
Bonds	1,000,000	1,000	48	55
Louisville	2,570,000	50	110	120
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	107½	109½
" 6 per cent. scrip, due 1910	100,000	25	25	87
Montreal, Canada	2,000,000	100	182	184¾
Newark, N. J., Con. Gas Co	6,000,000	..	..	55
Bonds, 6's	4,600,000	..	..	103
New Haven	1,000,000	25	300	325
Nashville Gas Lt. Co.	1,000,000	100	110	..
Oakland, Cal.	2,000,000	..	46	47
" Bonds	750,000	..	..	..
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DIVIDEND NOTICE.

OFFICE AMERICAN LIGHT AND TRACTION CO., JERSEY CITY, N. J., January 21, 1902.

The Board of Directors has this day declared a quarterly dividend of 1¼ per cent., for the quarter ended December 31, 1901, on the preferred stock of the Company, payable February 15, 1902, to preferred stockholders of record at the close of business on January 31, 1902, at which time the transfer books of the preferred stock will close, and will remain closed until February 17, 1902. Checks will be mailed.

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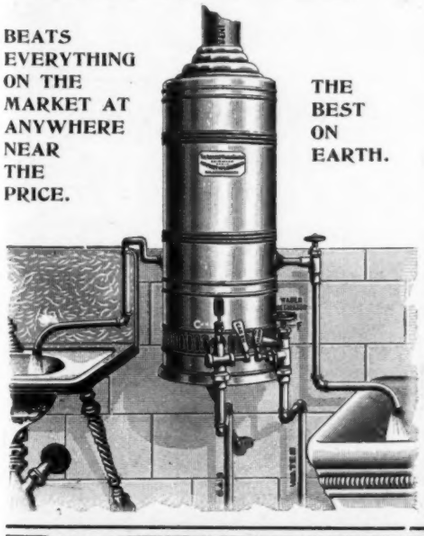

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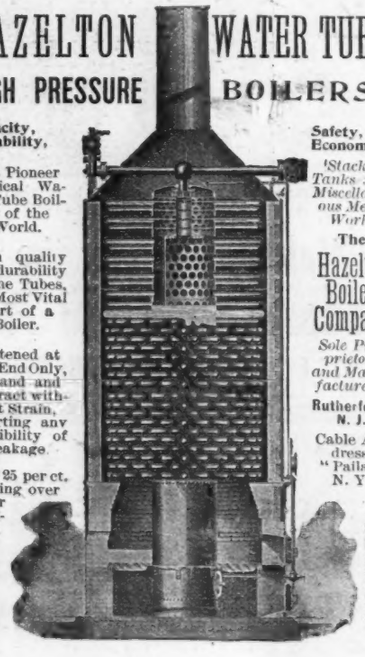

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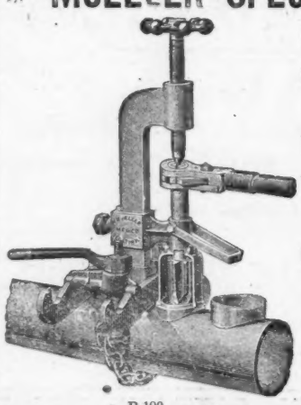

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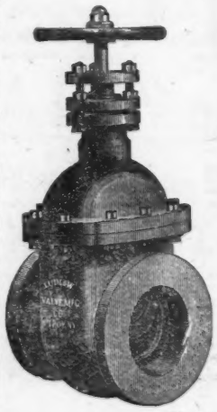

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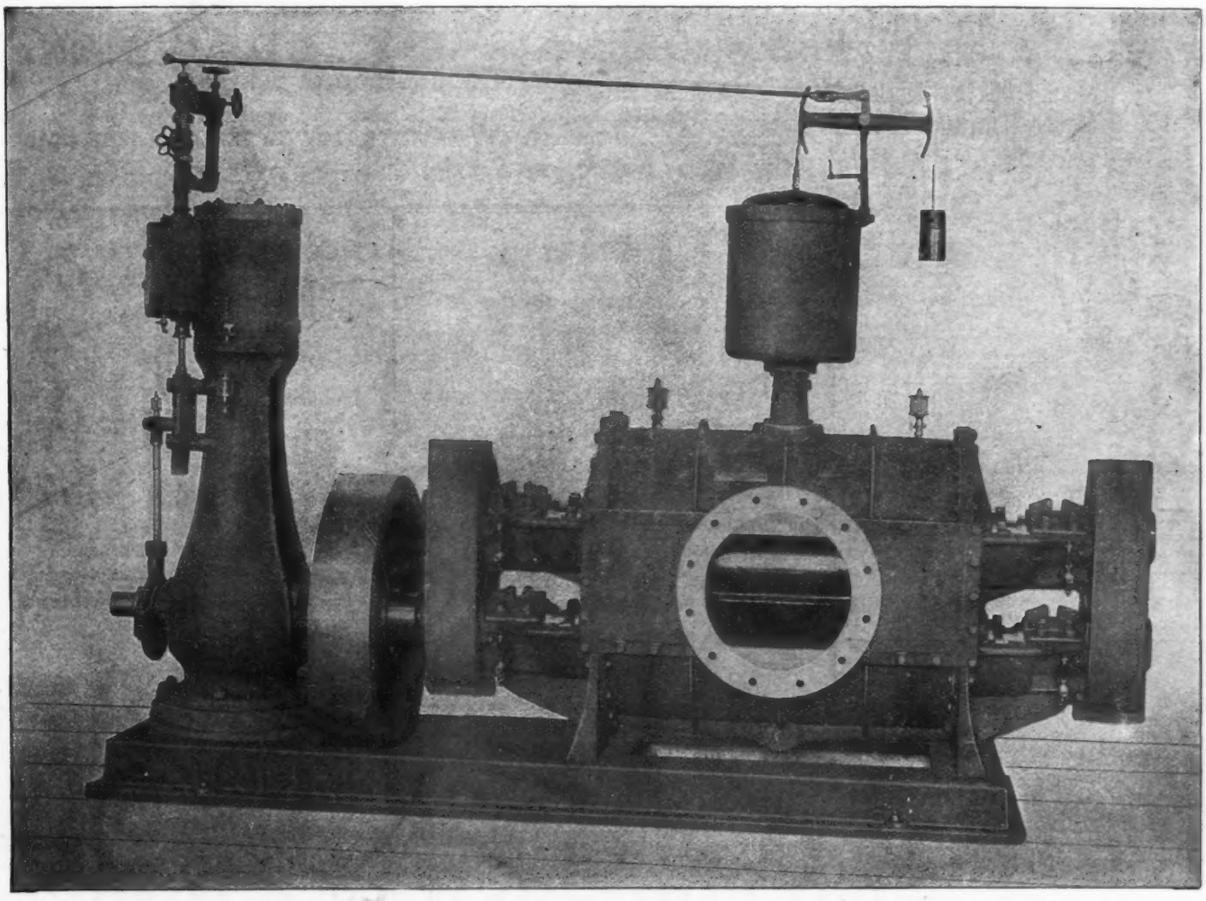

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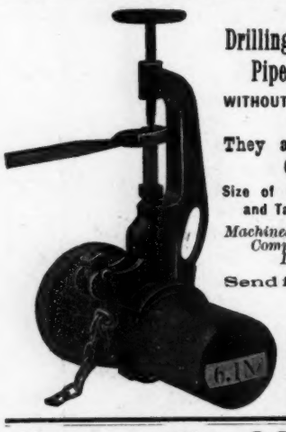

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Their Construction and Arrangement,

And the Manufacture and Distribution of Coal Gas.

Originally written by SAM'L HUGHES, C.E.
Rewritten and Much Enlarged by
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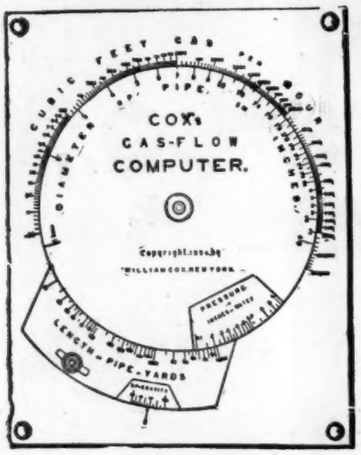

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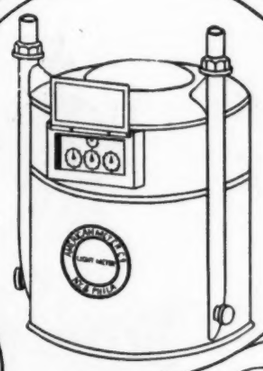
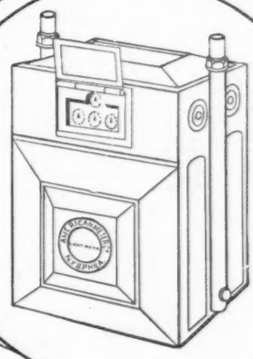
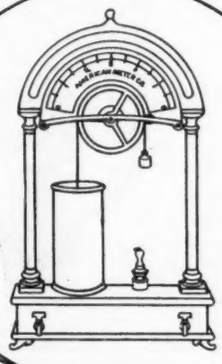


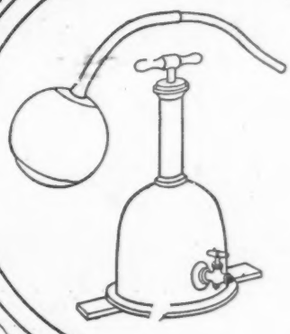


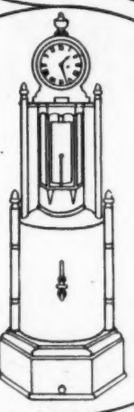


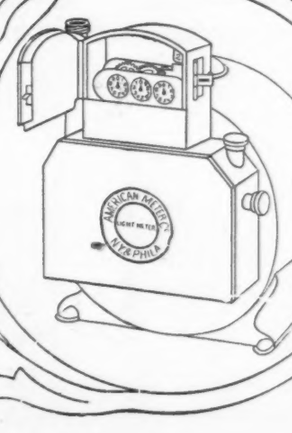
PUBLIC LIGHTING TABLE.

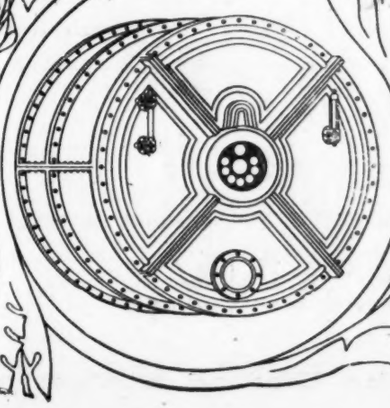
FEBRUARY, 1902.

DAY OF WEEK.	DATE.	Table No. 1. FOLLOWING THE MOON. Light.	Extinguish.	Table No. 2. NEW YORK CITY. ALL NIGHT LIGHTING. Light.	Extinguish.
				P.M.	A.M.
Sat.	1	5.40 PM	3.20 AM	5.05	6.15
Sun.	2	5.50	4.10	5.05	6.15
Mon.	3	5.50	5.00	5.05	6.15
Tue.	4	5.50	5.40	5.05	6.15
Wed.	5	5.50	6.10	5.10	6.10
Thu.	6	5.50	6.10	5.10	6.10
Fri.	7	5.50	6.10	5.10	6.10
Sat.	8	5.50 NM	6.10	5.10	6.10
Sun.	9	6 00	6.00	5.10	6.10
Mon.	10	6.00	6.00	5.10	6.10
Tue.	11	6.00	6.00	5.10	6.10
Wed.	12	6.00	6,00	5.20	5.55
Thu.	13	10.30	6.00	5.20	5.55
Fri.	14	11.40	6.00	5.20	5.55
Sat.	15	12.40 AM PM	6.00	5.20	5.55
Sun.	16	1.40	5.50	5.20	5.55
Mon.	17	2.40	5.50	5.20	5.55
Tue.	18	3.30	5.50	5.20	5 55
Wed.	19	4.10	5.50	5.30	5.55
Thu.	20	4.50	5.50	5.30	5.55
Fri.	21	No L.	No L.	5.30	5.55
Sat.	22	No L. FM	No L.	5.30	5.55
Sun.	23	No L.	No L.	5.30	5.55
Mon.	24	6.20 PM	9.20 PM	5.30	5.55
Tue.	25	6.20	10.20	5.30	5.55
Wed.	26	6.20	11.10	5.30	5.45
Thu.	27	6.20	12.10 AM	5.30	5.45
Fri.	28	6.20	1.10	5.30	5.45









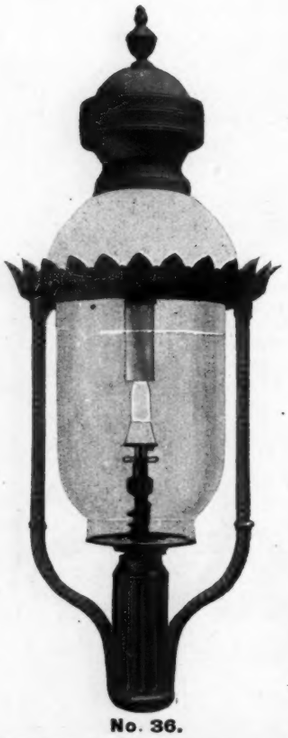
TOTAL HOURS LIGHTING DURING 1902.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	238.30	January	423.20
February	196.20	February	355.25
March	196.20	March	355.35
April	166.40	April	298.50
May	151.40	May	264.50
June	131.10	June	234.25
July	142.40	July	243.45
August	162.00	August	280.25
September	179.00	September	321.15
October	216.30	October	374.30
November	224.10	November	401.40
December	250.00	December	433.45
Total, yr.	2255.00	Total, yr.	3987.45

NEW YORK, 33 Nassau Street. PHILADELPHIA, Broad and Arch Streets. CHICAGO, Foot of Orleans Street. BOSTON, 624 Tremont Building.
CLEVELAND, 809 Cuyahoga Building. ST. LOUIS, 712 Roe Building. SAN FRANCISCO, 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



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Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

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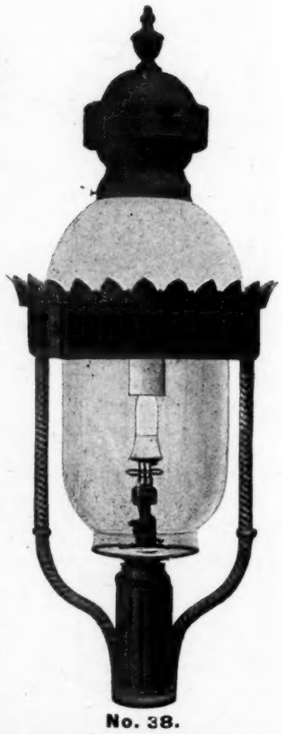
IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others Interested in Municipal and Outside Lighting.



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The most practical, efficient and artistic burner yet produced. . . . . .

It contains an improved adjustable Bunsen so constructed as to permit of a wide range of variations in gas pressure without blackening the mantles and without an adjustable air shutter. . .

It can be used with all styles and sizes of glassware, either shades or globes. No further necessity to carry a stock of different burners for the many sizes and shapes of glassware.

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Salesrooms in all the Leading Cities of the United States.

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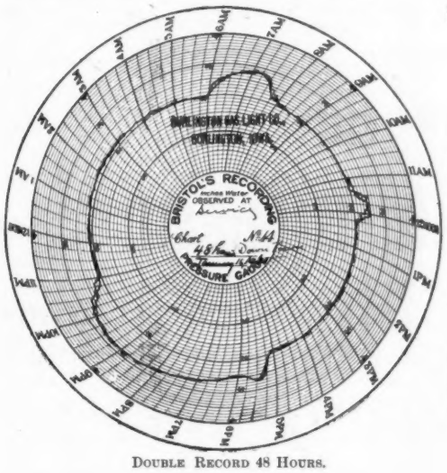

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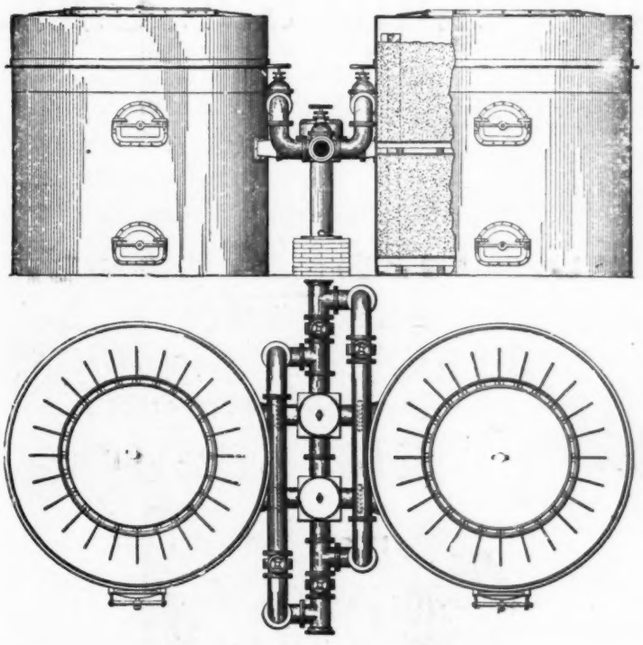

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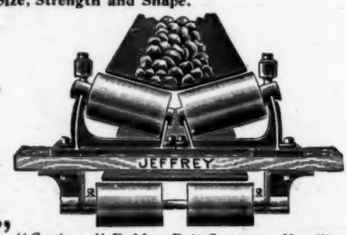

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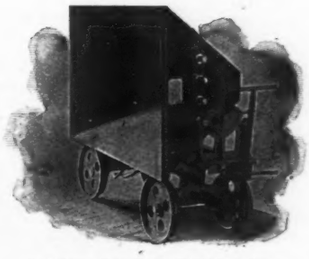

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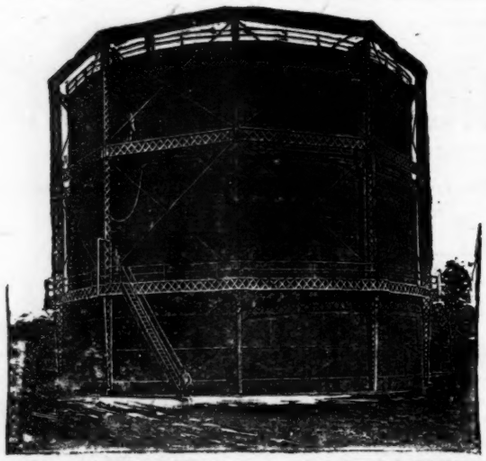

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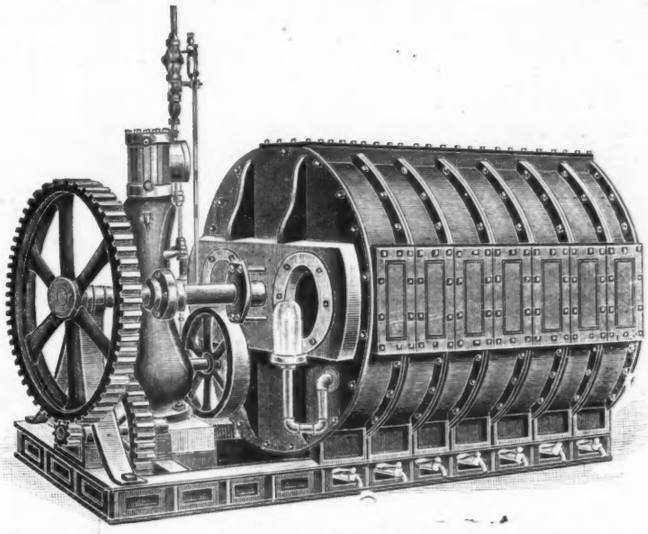

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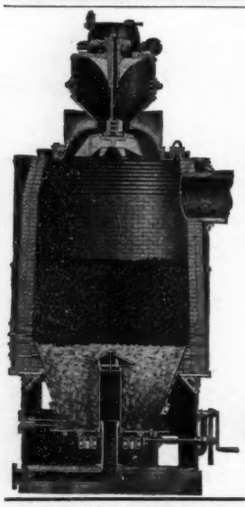

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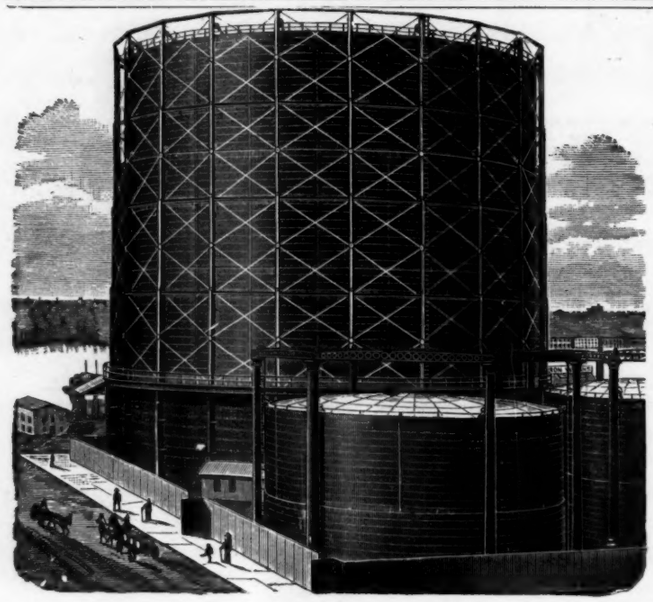

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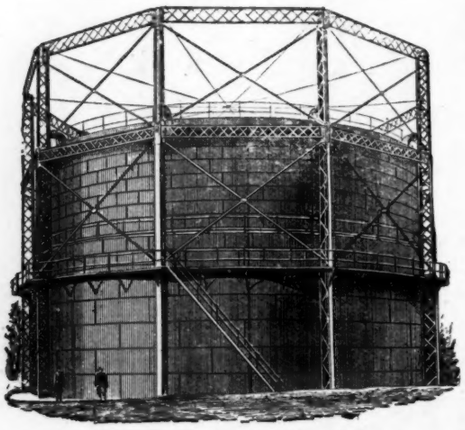

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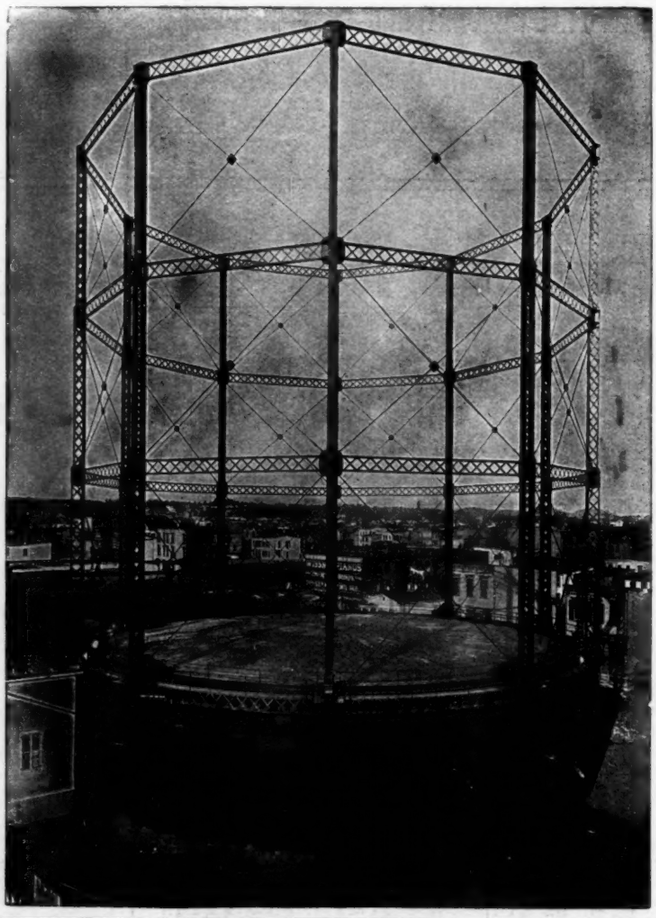

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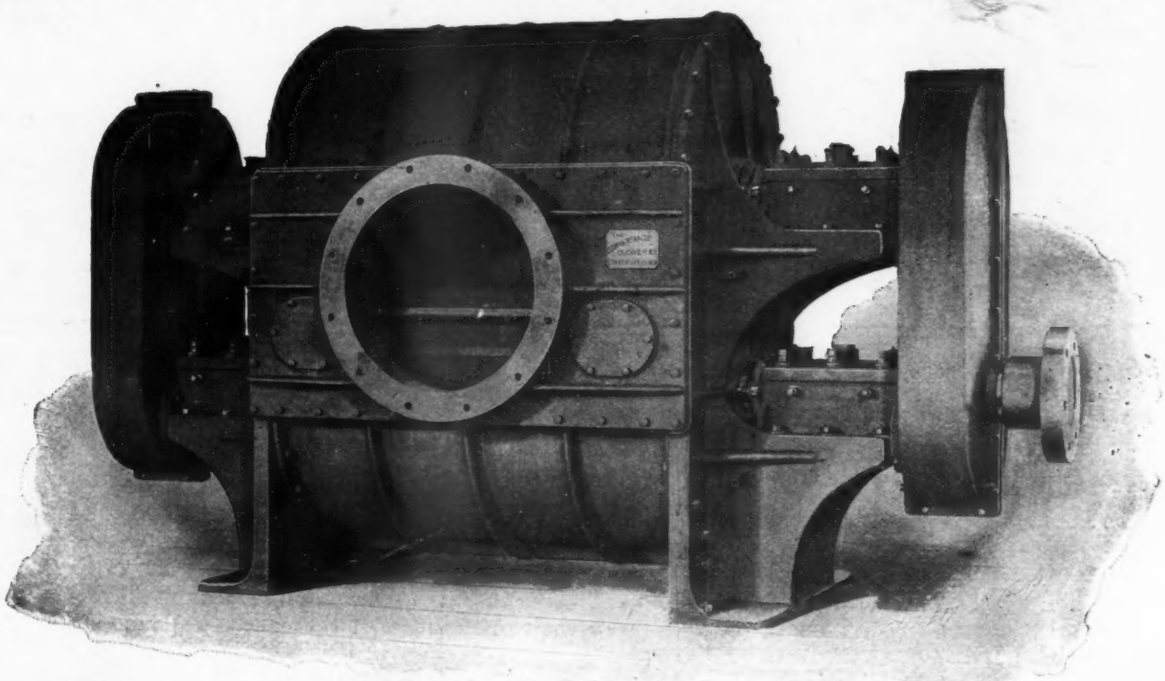

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